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ABSTRACT

Special education and school equipment for handicapped students, particularly for those in wheel chairs, are outlined with suggestions for increasing the quality and effectiveness of special education instruction. Guidelines are given for the provision of an adequate learning environment for handicapped students. Special furniture and equipment is discussed including--(1) tables and desks, (2) bookcases and storage cabinets, (3) chalkboards, (4) audiovisual and communication aids, and (5) mobility and postural equipment. Equipment needs in the different physical and functional areas within the school discussed included--(1) classrooms and laboratories, (2) cafeterias, and (3) recreational facilities. A reference list and appendix are included. (TG)

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HUMAN RESOURCES STUDY NUMBER 9

The Modification of Educational Equipment and Curriculum for Maximum Utilization by Physically Disabled Persons

Educational and School Equipment for Physically Disabled Students

Harold E. Yuker
Martin A. Feldman
John F. Fracchia
Janet H. Younng

1967

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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*3. Campbell, W. J., Leizer, R. R., & Yuker, H. E. A study of the adaptability of disabled workers, 1958.

*4. Slipyan, A., & Yanover, R. R. Continuing medical research programs, including a study of the effect of competitive industrial activity on the traumatic paraplegic, 1959.

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ALBERTSON, NEW YORK 11507

FOREWORD

This present series of monographs represents a significant departure in the publications of the Human Resources Center. Up to this point the Center's monographs have been descriptive and attitudinal studies concerning the disabled worker. In contrast to these, the present series of five monographs are reports relating to the education of severely physically disabled children.

Although these reports have a wide perspective they focus on Human Resources School. This school has been one of our most successful experiments. We feel that it is important to provide others with information about the school, as well as information about other major successful attempts at educating physically disabled children. This series of monographs attempts to integrate the available information in this area.

The United States today is placing more emphasis upon better education for all. With this emphasis, the education of the severely disabled child, formerly considered homebound, has become increasingly significant. It is our hope that the information contained in this series will contribute substantially to the improvement of the quality of education offered to disabled children throughout the United States and the world so that they can become independent and productive citizens.

Henry Viscardi, Jr., LL.D., L.H.D.
President
Human Resources Center

ACKNOWLEDGEMENTS

This series of monographs on the education of the severely disabled child is the result of the contributions of many people. Special recognition must be given to the faculty of Human Resources School for their important advice and meaningful criticisms, and the Human Resources research staff for their continuous cooperation. Without the help of all of these people, this series would not have been possible.

The authors would like to especially thank Frank D. Gentile, Mildred Goldberg, Roberta Housman, Russell Housman, Samuel Nemarich and Ruth Velleman for their active contributions and guidance in the preparation of this study on equipment.

PREFACE

The purpose of this series is to provide a comprehensive source of information pertinent to the education of physically disabled, intellectually normal children. The information presented should help those concerned to provide these children with an excellent education. A secondary purpose is to stimulate educators to think about problems that arise in educating physically disabled children, and to attempt to formulate their own solutions to these problems.

These publications are designed to fill a need for information about the education of physically disabled children. This need for information has been expressed by everyone from the school superintendent and the local school board to the classroom teacher and the physical and occupational therapists. The information explosion has not yet reached into this area. While many persons have worked out ingenious solutions to problems that arise, these solutions have not been publicized. There is a lack of communication. Someone, somewhere has probably solved any given problem, but few people know of the solution. Ultimately the regional curriculum centers in special education will provide this information. In the interim, the present series has been designed to "spread the word."

Thus, these publications are designed to serve as a preliminary, concise handbook of information about the education of physically disabled children. They present information about a wide variety of topics of interest to special educators. The material has been obtained from a number of sources. Much of it comes from a relatively extensive review of the literature. Over 800 books, articles, pamphlets, etc. were reviewed. Other information came from interviews with leading educators in various parts of the country.* Others, whom we were unable to visit made their contributions in writing.

The series of reports has been organized into six topics, each dealing with a major aspect of the education of disabled children. The discussion of each topic includes a general introduction, a series of problem areas each with a solution or solutions, a summary, and a list of references. The problems covered are generally those of greatest concern in the field; the ones most apt to arise when two persons concerned with the education of physically disabled children get together. The solution that is given is based on information obtained from the sources described above. It represents our interpretation of the thinking current in the field today. In some cases, when more than one solution is discussed, it may indicate either that there is disagreement among the experts or that the authors disagree with the experts. In such cases, the reader is invited to draw his own conclusions which he should do anyway, even where only one solution is given. In other instances, the solutions presented represent alternatives for coping with various specific situations. The purpose of this series is as much to get people to think and come up with their own solutions as it is to provide ready-made solutions.

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*The authors would like at this point to formally express their thanks to the many persons who so willingly shared their information with us. Much of the information and inspiration in this series stems from these persons. While a complete list of persons who gave of their time is not appropriate here, it can be found in the Appendix at the end of each volume.

The bibliography at the end of each monograph is in some respects the most important part of the series. It lists the primary sources that provide the important details that were omitted from the present publications. In organizing this series a choice had to be made between breadth and depth. We decided to attempt to present a broad picture of the education of physically disabled children, sacrificing depth of presentation in the process. The depth can be provided by use of the references.

Both the solutions, and to a lesser extent the problems are permeated by the educational philosophy of the authors of this series. This philosophy can be expressed as a series of assumptions:

1. Good education is defined in terms of external criteria, and is judged according to these criteria. The principal goal is providing maximal educational opportunities to each individual regardless of whether he is disabled or non-disabled.

2. It is desirable for disabled persons to attend integrated schools whenever possible.

3. Facilities and curricula should be planned for optimum use by all students.

4. Specific individual needs should be provided for to the extent possible within the confines of statement #3.

5. Many of the special adaptations for disabled students can be useful for non-disabled students as well.

It is realized that some of these assumptions are arguable - and their pros and cons are discussed in the series. Nevertheless, it is important that the assumptions be understood since they will enable the reader to discount some of the biases that appear throughout the series.

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INTRODUCTION

Many of the barriers encountered in the school environment by children with physical disabilities are created by items of educational equipment. For example, a student with limited use of his hands may not be able to make the fine adjustments necessary to focus a microscope in a science laboratory. However, in a classroom equipped with a set of microscopic slides and microprojector even the most severely disabled student can discover the wonders of nature. This type of shared presentation also ensures that all students are presented with the same stimulus allowing for both a group experience and individual exploration of the entire microscopic specimen. This type of presentation can be educationally advantageous for disabled and non-disabled individuals alike.

It is the general purpose of this monograph to discuss school equipment that is non-limiting in the sense that it presents no barriers and/or removes any barriers which might be encountered by a student with a physical disability. An attempt will be made to provide a guide to modifying and selecting equipment for maximum utilization by disabled students. To this end several examples will be presented from the experience at Human Resources School as illustrations. It should be noted that, in general, equipment will be discussed in this monograph with little consideration given to curriculum. While this has been done for the sake of convenience for those who will use this volume as a source book or reference, it is recommended that a more comprehensive, integrated overview of the education of physically disabled students may be derived from reading this volume in conjunction with that dealing with curriculum and instructional techniques; Human Resources Study No. 12.

Items of school equipment will differ in the degree to which they can be used by persons with varying disabilities. That is, depending upon the severity or type of disability, a point is reached at which an item of equipment is no longer non-limiting for a particular student or group of students. Hopefully, in many instances, a well designed item of equipment will be usable by a fair-sized segment of the disabled population.

If conventional items of educational equipment are designed to be non-limiting to students with physical disabilities, educational benefits might accrue to non-disabled students using the equipment as well. For example, a classroom with rows of fixed desks presents physical barriers as well as safety hazards to students confined to wheelchairs, litters, or using crutches. If easily accessible, adjustable tables replace the immovable seating equipment, the additional leg-room, larger work areas and more flexible seating arrangements gained will benefit all students. Equipment capable of serving all students with little or no modification is most desirable. This implies that all school equipment should be evaluated in terms of its possible use by disabled persons in addition to such factors as cost, appearance, durability, etc. That is, an additional evaluative dimension for the inclusion of a piece of equipment in the school is the degree to which mobility, dexterity, or strength are necessary for its use.

The basic areas within a school may be divided into a number of physical and functional units such as classrooms, science laboratories, home economics rooms, arts and crafts rooms, the library and study areas, assembly hall, cafeteria, greenhouse, gymnasium, etc. Certain kinds of equipment are needed in most rooms in a school. The children must be provided with work space, seating, ways of communicating and presenting their work, etc. Additionally, children with physical disabilities may require, dependent upon the kind and degree of disability, equipment not usually found in school rooms such as mobility devices and postural aids. Magnifico (1958) suggests that "in general there should be ample space for wheelchairs and other orthopedic equipment in the classroom. Desks and chairs should be constructed so as to make each child as physically comfortable as possible. . . to work and play with maximum efficiency" (p. 324). Wilson (1964) points out that in addition "the classroom and equipment provided for these children should be designed to allow for freedom of movement and independent living. . . . " (p. 489). In this regard it should be noted that both the technology for and the philosophy of educating the physically disabled have advanced rapidly making it possible and desirable for the disabled to do many things they previously would not have been able or expected to do.

There are four general types of equipment that can be used in a school with disabled children: standard unmodified school equipment; standard equipment that has been modified; specially designed, commercially available equipment; and specially adapted equipment, "made to order" for students with special needs.

1) Standard, unmodified school equipment is available from manufacturers of educational equipment. Some of this equipment may be used by both disabled and non-disabled children. It is usually less expensive than any of the three other types. Because of its greater utility and lower cost, this kind of equipment should be considered first and used whenever feasible.

2) Modified standard equipment refers to regular equipment which has been changed in some way so that its use by disabled persons is facilitated,

e. g., attaching a "crutch holder" to the side of a desk. The modification is usually made at the school, not by the manufacturer. Modifications are generally easily done and relatively inexpensive.

3) Several manufacturers of educational equipment provide items that are specially designed for use by disabled children. Information about firms which manufacture specially designed educational equipment may be obtained from: Bailey Manufacturing Co. (not dated), Edgington & Tucker (1963), Martin (1963), Moore (1958 & 1962), and New York University-Bellevue Medical Center (1958).

4) Specially designed or adapted "one of a kind" equipment designed to meet the needs of a particular student is usually made at the school and its cost can vary greatly.

There is a difference of opinion with respect to the relative desirability of equipment in each of the above categories. Some authorities take the view adopted in this monograph that standard equipment should be used or adapted whenever possible. Others such as Schoenbohm (1962), in recognizing the need for specially designed equipment, recommend forethought in its selection. Thus, he states:

> While there is on the market today a great deal of commercially manufactured special equipment for crippled children and adults... it is extremely important that all equipment purchased be related to the need it is intended to fulfill. The individual needs of individual crippled children vary so much that many items of equipment will need to be specifically constructed to meet their needs.... Equipment, further, should be judged by its functional value rather than by appearance or expense.... Despite the fact that elaborate and expensive equipment might look nice in a department, its simplicity and functionality will be the true test of its value and effectiveness (pp. 89-90).

While Schoenbohm is more concerned with rehabilitation equipment found in a school than with educational equipment, his comments are relevant for both.

In this regard, it is standard policy of Human Resources School to utilize standardized educational equipment where possible. Too often schools order and purchase unnecessary special equipment due to the lack of knowledge regarding new advances in standard equipment design and materials. Technology in this area is moving more rapidly than many people realize. It is generally advisable to consult a design engineer or independent salesman since he usually has the broadest knowledge of the latest in educational equipment.

Some of the problems that arise from the use of the specially designed "one of a kind" equipment are mentioned by Nakatsukasa (1967) in reporting on teaching materials, tools, and equipment devised to meet the special needs of disabled children in Japan. He notes that "teaching materials and tools which were devised to meet the needs of some one pupil often become unnecessary and were left unused after the physical condition of the child changed or after he left the school." This statement reinforces the concept that for maximum economy and use most equipment should be flexible enough to serve several students rather than just one. On the other hand, while it is generally desirable to provide equipment flexible enough to serve several students, no one student's need for a unique item of equipment should be overlooked.

One final quote may serve as a summing up of these introductory remarks. Wilson (1964) has pointed out that:

> Children with crippling and chronic health conditions... are an extremely heterogeneous group in the varieties of disabilities [they manifest]... the type of defect will determine the adjustments [necessary] in their school programs.... Every effort should be made to place these children in the regular classroom where they will have the opportunity to grow up in the world of the non-handicapped in which they will spend the majority of their lives.... In attempting to reach this goal it is important to remember it is not the physical facilities or equipment that make a good program. In fact, there is a real danger that special provisions for children... may be made too specialized and that students may become so surrounded with gadgetry designed to make things easier for them that they never learn to cope with the world outside the classroom walls (pp. 510-511).

While economy and maximum usability are criteria to be considered in the selection of educational equipment for use by disabled students, instructional effectiveness and instructional quality are more important. The goal is to employ equipment that will facilitate the students' educational experience.

GENERAL FURNITURE AND EQUIPMENT

In this section the items of furniture and equipment that are apt to be found in all classrooms and in many of the specialized rooms within a school will be discussed. Included are desks, chairs, tables, storage cabinets, and bookcases as well as chalkboards, audiovisual aids and the like. The next section will consider the equipping of specialized areas in the school.

An extremely comprehensive alphabetically organized list of furniture and equipment for classrooms containing orthopedically handicapped children has been prepared by Richard W. Outland (1967), Consultant in Education of Physically Handicapped Children, California Department of Education. This list includes the kinds, suggested number, and approximate cost of equipment for preschool, primary, intermediate, post intermediate and speech classes. The list consists, with a few exceptions, of items that are standard and commercially available. In addition, Outland's list includes items of equipment which are necessary in carrying out the administrative, medical and custodial functions.

A. Tables and Desks. While desks are commonly used to provide a work area for students in a class, there are some good reasons for believing that the fixed desk and chair unit often seen in the classroom are undesirable for children with physical disabilities. The student in a wheelchair could not typically avail himself of this type of equipment. A student wearing braces and employing crutches would have difficulty in getting into and seating himself at his desk. Room arrangement is also limited. There currently seems to be a general trend away from such fixed seating and toward the use of tables as work areas. This overcomes many of the above difficulties.

A basic guide for selecting a table that will be suitable as a desk or work area for students with physical disabilities as well as non-disabled students is that its height should be adjustable. This feature enables a single table to be used in many grade levels and also enables the tables to be set at the heights needed to accommodate wheelchairs. An additional, but not necessary, feature that Torrey (1960) points out is a pedestal base which tends to make the table more accessible to the wheelchair bound student.

Both the American Seating Company (1965) and the Peabody Seating Company (not dated) manufacture "all purpose" tables that provide varied arrangement possibilities in the classroom. These tables can be adjusted in height from 20" to 30" and come in a wide variety of sizes and shapes (rectangular, round, square, half round, trapezoidal). The table tops are constructed of a plastic laminate for durability and ease of maintenance. Some of the American Seating Company's models have pedestal bases. The particular tables discussed above have been selected for citation only because they are good examples of all purpose tables that meet the criteria for use by students with physical disabilities. Any commercial supplier of conventional school equipment whose product embodies the essential characteristics mentioned may be considered as a potential source of the equipment. Figures 1 and 2 illustrate that the use of all purpose adjustable tables facilitates flexible room arrangements. Figure 1 shows the traditional arrangement of rows of desks while Figure 2 illustrates a U-shaped arrangement.

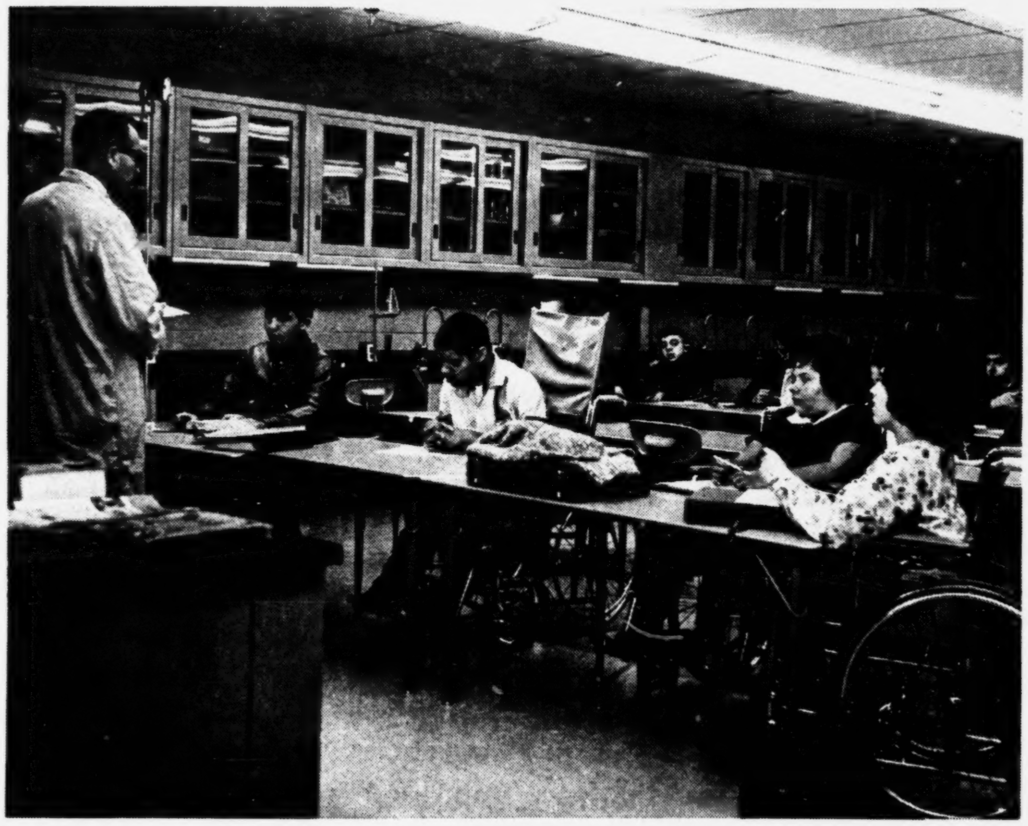

FIG. 1. The traditional arrangement of rows of desks using all purpose adjustable tables.

Tables that have been designed with the physically disabled individual

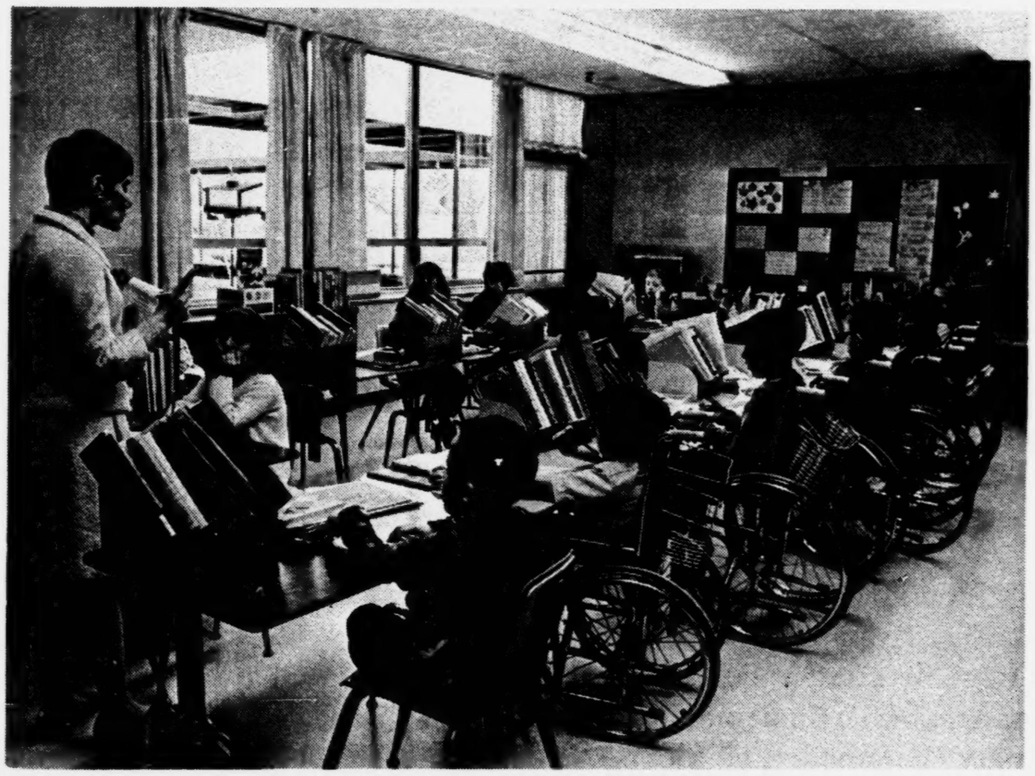

FIG. 2. U-shaped arrangement using the same equipment shown in Fig. 1.

in mind are manufactured by the J. A. Preston Corp. (not dated), and the Bailey Manufacturing Company (not dated), among others. The tables available from these sources differ from the previously mentioned tables in that the tops have cutout places for a person in a wheelchair. They can be purchased as individual or multiple place units with some choice in size and shape. Some of these tables are described by Moore in Rehabilitation Equipment and Supplies Directory (1958). Unless the cutout top feature is considered absolutely essential, the all-purpose tables seem better since they are more flexible in terms of seating arrangement, cost less, and are easily used by non-disabled students.

It may be necessary to modify already existing school equipment for use by a student with a physical disability. In some cases, the removal of a row of desks will provide room for wheelchair bound students. Rusalem (1962) suggests that a lapboard can serve as a work, writing, and study surface, but this is not as good as most other arrangements. Schoenbohm (1962) describes a special cutout desk top that fits over the ordinary desk. This desk top has a ledge to keep pencils and crayons from falling off, a blackboard, and a tackboard as well as a narrow cup tray. These modifications would especially benefit a poorly co-ordinated spastic child. Tables that are too low for wheelchairs could be raised by placing wooden blocks under the legs. The blocks should be broadbased and have holes in them into which the regular table legs can fit so that the stability of the table will not be adversely affected. At the Love Grove Road School in Jacksonville, Florida tables have been modified so that they may be easily raised or lowered according to the student's needs. Here, the rectangular steel legs supporting the table have been fitted with a device comparable to an automobile jack by which the height of the table may be raised or lowered. Again, if cutout sections are deemed absolutely necessary, regular wooden topped tables can be cut out to accommodate a wheelchair. Naturally, this modification would make it less usable by non-disabled students because it reduces work area. Such relatively simple modifications will, in many cases, be sufficient to remove physical barriers to the disabled.

For non-disabled students or students with physical disabilities that do not confine them to wheelchairs, student chairs will be needed in the classroom. Regular student chairs constructed of wear and abrasion resistant plastic are suggested. Chairs made of flexible plastic are best since they will not crack from the impact of a child sitting down with braces. The chairs should also be wheelchair height (15-20 inches depending on the age of the children) for ease of transference and some should be available with arms for the ambulatory child on crutches. While sturdy wooden chairs might also serve, plastic and tubular frame chairs are lightweight and can be moved by students in wheelchairs if necessary, thus making for increased classroom mobility. Included in the numerous types of student chairs described in the Peabody and American Furniture catalogs is a lightweight student chair that is adjustable in height and made in three sizes that fit all grade levels. Again, any conventional student chair that incorporates the desirable features of the models cited can be used.

An additional source of information regarding student chairs may be found in the Fixtures Manufacturing Corp. brochure, (not dated).

B. Book Cases and Storage Cabinets. Book cases in the schoolroom are usually found along the perimeter of the room and in most grades all shelves can be reached by students in wheelchairs. Metal counter-height book cases in a variety of sizes and with adjustable shelving can be obtained from manufacturers such as Penco (not dated) and Supreme Steel Equipment Corporation (1960). Supreme also makes a storage cabinet with adjustable shelves and sliding doors, a feature that makes the unit space conserving. If the doors slide easily, this feature could also make the unit more convenient for disabled students than the conventional swinging door cabinet. In the Human Resources School the bookcase units and storage cabinets are constructed of Neva-mar, a plastic laminated surface that is extremely scratch and scuff resistant. This treatment is desirable in that it protects exposed areas from damage that might result from encounters with wheelchairs and braces.

C. Chalkboards. Chalkboards and corkboards need only to be installed at a lower than standard height in order to make them accessible to wheelchair bound students. While having the boards installed 3 - 6 inches away from the wall is desirable in that such an installation allows the wheelchair student to get closer to the board, it is also possible to write if the wheelchair is placed parallel to the board. An aluminum framed chalkboard with an "easy eye" green writing surface and a multigrooved chalk trough is a good illustration of a commercially available chalkboard that can be used by students with physical disabilities. Such boards are available in seven sizes ranging from 15" x 24" to 48" x 96". Corkboards of similar construction are available in three sizes, 18" x 24", 24" x 36" and 36" x 48" (Nor-wood, 1964). Figure 3 illustrates that a student confined to a wheelchair may use a blackboard installed at a suitable height. In some instances a portable chalkboard can serve as a supplement to or replacement for conventional wall mounted units. The Barricks reversible chalkboard and stand (Nor-wood, 1964) which comes in three sizes, is an example of this kind of equipment. If a portable board (approximately 20" high at its lower edge) is selected, use by students in wheelchairs is greatly facilitated.

D. Audio-visual Aids. A basic guide to audio-visual aids has been provided by the New York City Board of Education, Bureau for the Education of the Physically Handicapped (1962). The Bureau recommends the following audio-visual equipment for its classes for students with physical disabilities; a 16-mm sound projector, a film strip and 2 x 2 slide projector, lenticular screen 50 x 50, 2 projection tables, tape recorders, radio and mobile 21" television receiver. The list does not include an overhead projector such as the "Porta-Scribe" (Charles Beselers Company, not dated), found to be extremely useful in the Human Resources School. The image projected by this device is often larger than that which would be visible on a blackboard thus making for more comfort-

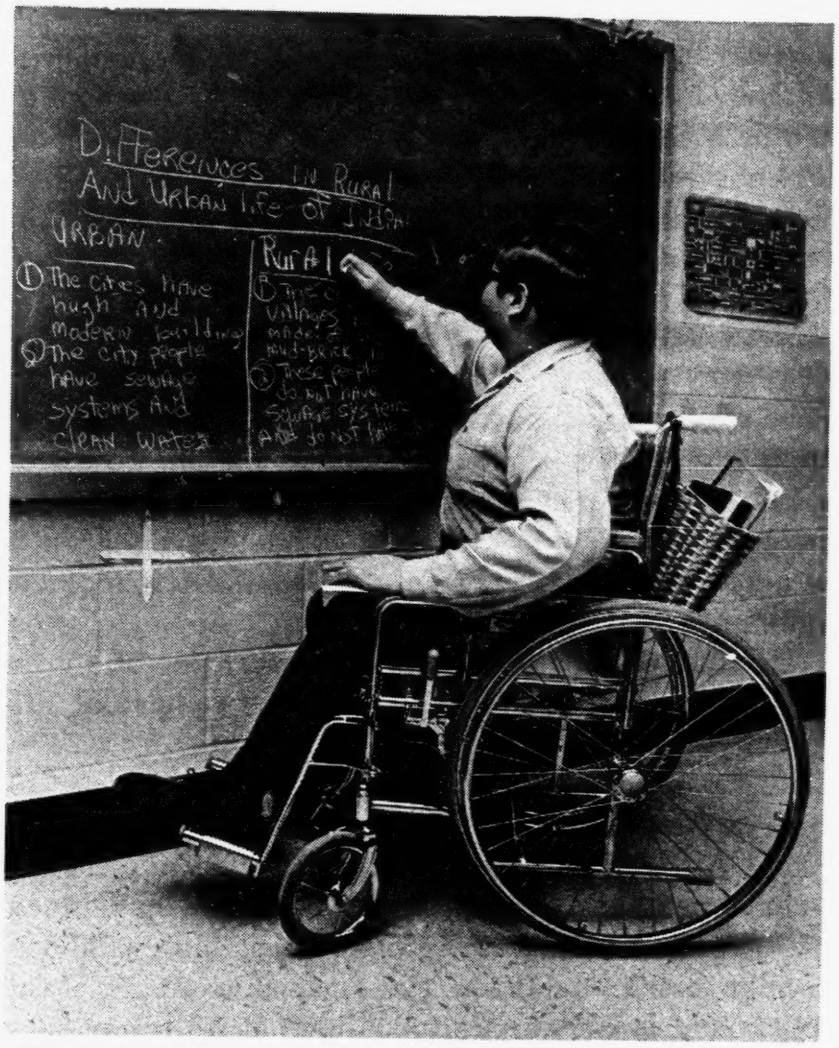
Differences in Rural
And Urban life of India
URBAN
Rural
① The cites have
high and
modern building
② The city people
have sewage
systems and
clean water
villages
mud-brick
② These people
do not have
sewage system
and do not

FIG. 3. A wheelchair student using a traditional wall mounted blackboard installed at a height of approximately 30" from the floor.

able viewing. Students can also prepare their work on materials that can be projected by this device so that an alternative to chalkboard work is provided. Teachers may prepare their work or displays in advance also, which many find extremely useful. Figure 4 shows the enlarged image cast by the overhead projector while Figure 5 illustrates a student using this device while seated at her desk.

Additional information regarding audio-visual aids may be found in the following sources: A. V. Communication Review (1966), Coss, Forney, Wendland, and Pedersen (1966), Crosby (1966), New York City Board of Education (1964-65 & 1965), Rufsvold and Guss (1961), and Thompson Manufacturing Company (not dated).

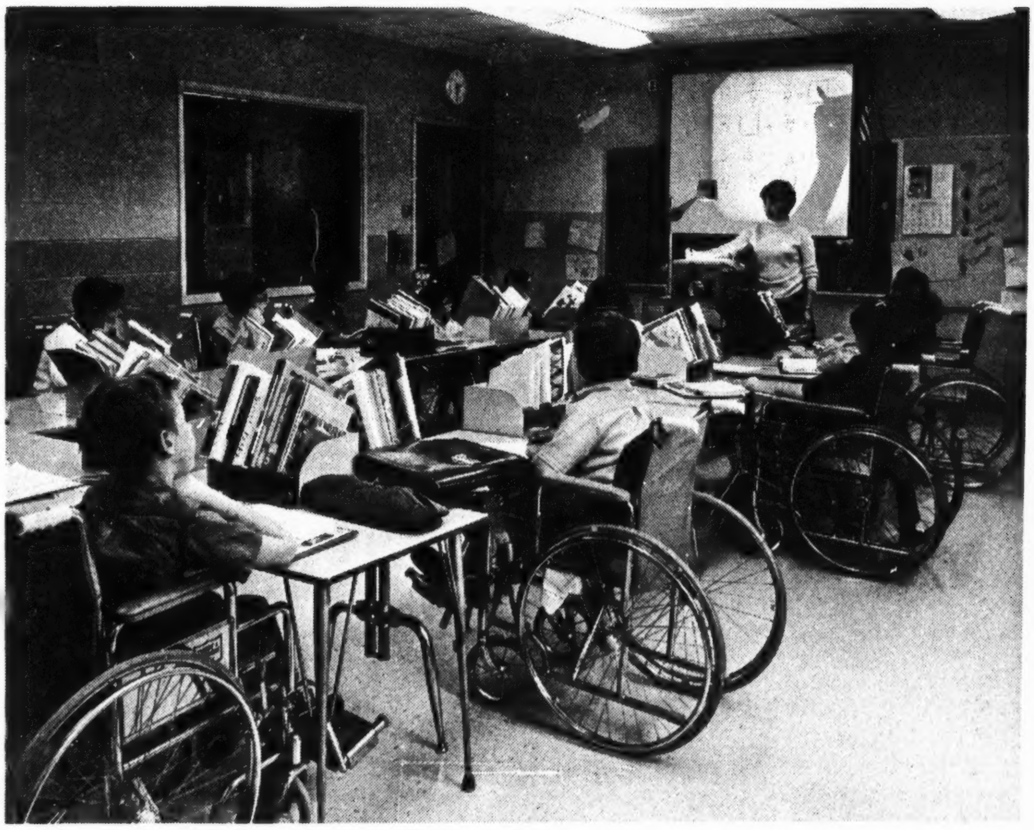

FIG. 4. Enlarged image cast by the overhead projector on a screen at the front of a room.

E. Mobility and Postural Equipment. A school providing educational facilities for children with physical disabilities may wish to provide special mobility and postural equipment for these students. While this equipment is not educational, its presence in the school may be helpful in making an education possible for a physically disabled child. Schoenbohm (1962) suggests that a school with physically disabled students have available such items as adjustable walkers (child, junior, and adult sizes), wheelchairs (hand and motor driven), litters, standing tables, and relaxation chairs. These types of equipment should be considered individually in terms of the disabled population in the school. Publications of the American Heart Association (1965), British Red Cross Society (1964), National Society for Crippled Children and Adults

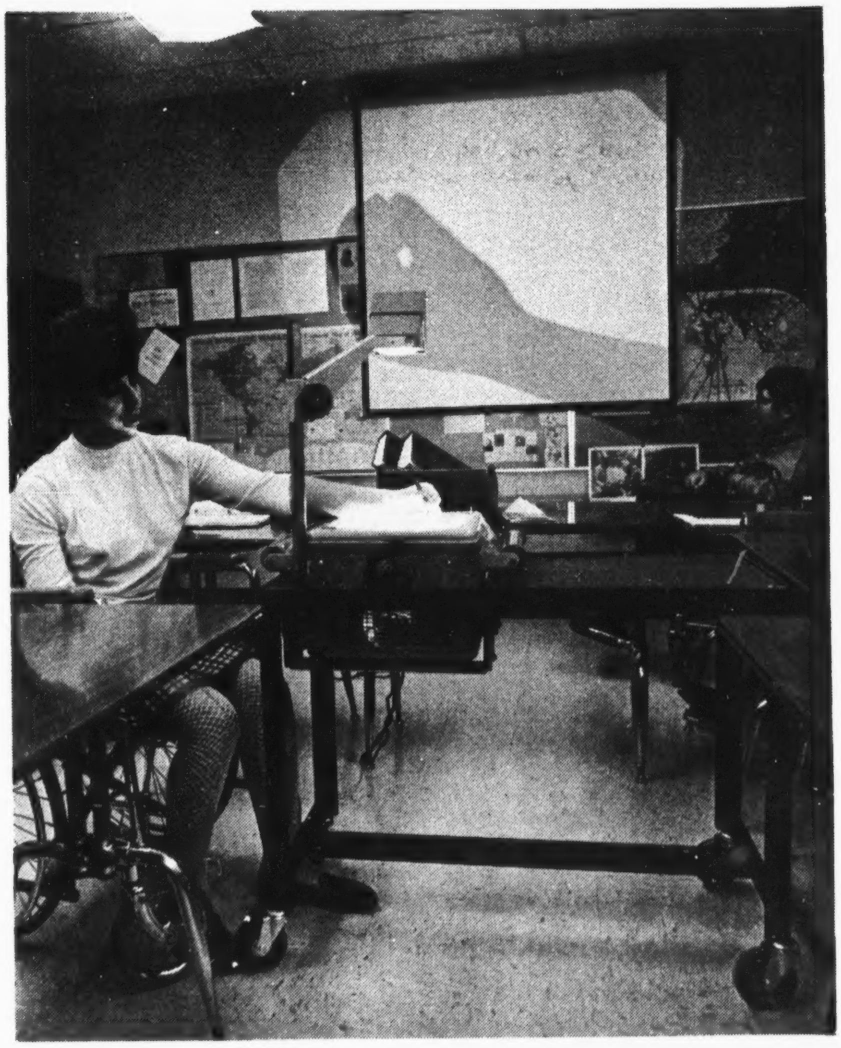

FIG. 5. Student using the overhead projector while seated at her desk.

(1950), New York University-Bellevue Medical Center (1958), and the Bulletin of Prosthetics Research of the Veterans Administration, Department of Medicine & Surgery (published periodically) are valuable sources of information about these kinds of equipment.

Some schools believe it important that this equipment be supplied while others do not. Those who favor its use point out that such equipment makes transporting the child considerably easier. Opponents point out that it is more realistic to teach the child to deal with the conditions that he will meet in the outside world. While Human Resources School has attempted to maintain as realistic an environment as possible, rehabilitation equipment is utilized wherever the disabled child can be made more independent. For example, motorized wheelchairs are used by those with severe involvement to enable them to move about independently.

Additional information regarding mobility and postural equipment is available from the following sources: Corporation for Medical Engineering (not dated), Rehabilitation Literature (1965), Symington, Ford, and Taylor (1965).

F. Communication Aids. This type of equipment will be particularly necessary if some students have disabilities that hamper communication. Some children with poor coordination or weak upper extremities cannot write legibly so typewriters might be needed in the classroom. Electric typewriters require 1/10th to 1/15th the finger pressure needed to operate a normal typewriter and reduce energy expenditure by 95% (Schoenbohm, 1962). Typewriter shields which can be fastened over the keyboard are available for those children whose coordination is so poor that they have difficulty striking individual keys accurately. The Dvorak typewriter with a rearranged alphabet on the keyboard and a book on one-handed typing can be used to teach children with only one good hand to type (Schoenbohm, 1962). But a problem will arise when the child has to use a regular typewriter. Typing sticks which can be held between the teeth can be used by disabled students who cannot use their hands. Sticks can be attached to holders that fit in the hands of those capable of using their hands but not their fingers. Typing sticks might also be inserted in headbands for those children who have use of their head and neck but who lack the fine motor coordination needed to type in the conventional manner. Jenkin (1967) describes the Possum typewriter, an application of "patient operated selector mechanisms" (P. O. S. M.) developed for the severely disabled at Stoke Mandeville Hospital in England. According to Jenkin, P. O. S. M. "equipment has been extended for use with an electric typewriter, offering many severely physically handicapped children and adults in schools and at home a positive means of communication hitherto denied to them" (p. 9).

A rather comprehensive presentation of how writing aids can be adapted for individual children whose grasp is weak or unsteady has been compiled by the American Heart Association (1965) and the British Red Cross Society (1964). Examples of the types of writing aids described are a pencil pushed through a perforated practice golf ball or a piece of elastic stapled or stitched to fit the thumb, first finger, and pencil. These devices are typically home-made, relatively simple to construct, and can be quite effective in assisting physically disabled students in writing. Figure 6 shows a disabled student learning to use an electric typewriter to facilitate communication.

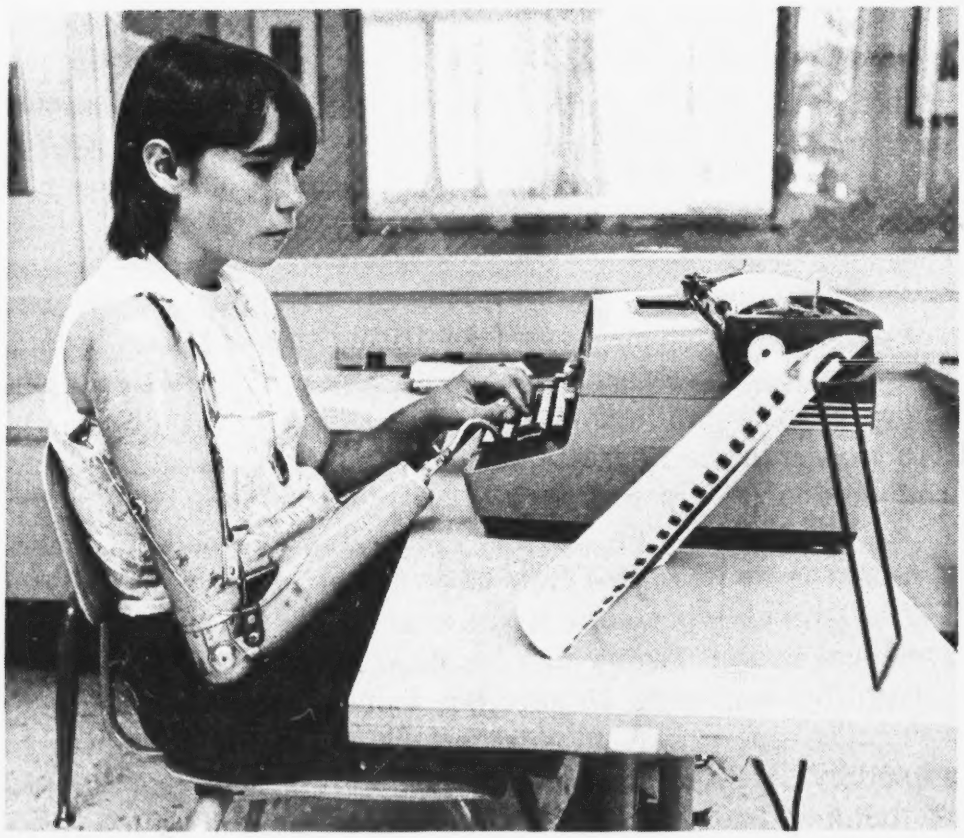

FIG. 6. Disabled student learning to use an electric typewriter to facilitate communication.

Additional information regarding communication aids may be found in the following sources: American Library Association (1967), Blackhurst (1965), Brown (1965), Carr (1964), Device News (1963), Lascelle (1956), Micheelsen (not dated), Pelone & Simches (1961), Richards (1963), Toomey j Gazette (1962), and the University of the State of New York (1966).

EDUCATIONAL AREAS

The following section will deal with the equipment needs of the different physical and functional areas within the school, discussing each area separately. Almost all of these areas will use some of the items discussed in the preceding section.

A. The Classroom. The classroom should be equipped with as many items of the equipment described in the first section needed for the particular class being instructed. In addition, each classroom should be equipped with a commercially available electric pencil sharpener which is easily used by both disabled and non-disabled students. The kind of, as well as number of, items required will be determined by such factors as class size, number of students with disabilities, kind of disabilities, range of severity of disabilities and the like. Where possible every effort should be made to select commercially available equipment that can be used by the disabled and non-disabled alike.

B. The Science Laboratory. The science laboratory typically has presented a "keep out" sign to the physically disabled student since many administrators of conventional schools voice the opinion that laboratory equipment is too dangerous for the non-able-bodied student. As a result, there has been little attempt to develop a model science laboratory adapted for the disabled student. The laboratory at Human Resources School is the only one in existence to the best of the authors' knowledge. The laboratory at this school has done away with the difficulties and dangers encountered by physically disabled students which result from work stands that are too high, aisles that are too narrow to accommodate a wheelchair, equipment placed out of the student's reach, and often a general crowding together of work areas. Much of the standard, commercially available laboratory equipment produced by such firms as the Hamilton Manufacturing Company (1962), Metalab Equipment Company (1961), and the Taylor Manufacturing Company (1962) is usable if the equipment is made accessible and some care is taken to select easily operable items. The sinks, gas, and water controls should be within easy reach of the students and accessible to those in wheelchairs. Batwing faucets and gooseneck spigots are two features that are helpful for those with upper extremity orthopedic involvement. The batwing faucets require minimal manual dexterity for manipulation while the gooseneck spigot allows for greater ease of operation by providing ample room between the sink and the spigot. These aspects of the science laboratory are discussed in greater detail in the monograph dealing with physical plant layout; Human Resources Study No. 8. Figure 7 illustrates the work stations in the science laboratory at Human Resources School, each of which is equipped with batwing faucets and a gooseneck spigot. Electrical outlets are also provided at each work station.

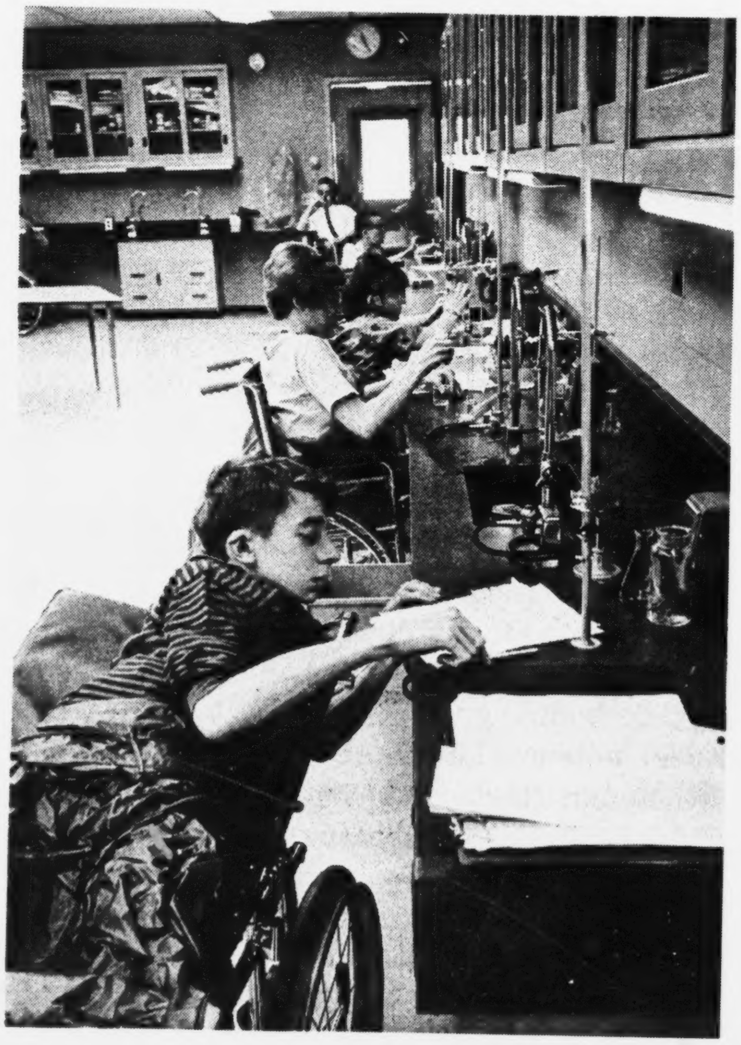

FIG. 7. Perimeter work stations in the science laboratory at Human Resources School. Each station is equipped with electrical outlets, gas and air valves and a sink which has batwing faucets and a gooseneck spigot.

For demonstrations, an overhead pivoting mirror installed in a vertical position above the demonstration table allows the students to view demonstrations performed at the teacher's table from their seats, without crowding about the table. The mirror can be adjusted by the teacher to a position that allows most students to view comfortably the demonstration without leaving their regular seats. This technique has particular advantages for physically disabled students with ambulation problems or on litters. Such a set up would similarly facilitate viewing of demonstrations by non-disabled students and help in the efficient use of class time since no time need be lost in leaving and returning to seats. In addition, the use of a video tape closed circuit television set up with large screen monitors allows for easy viewing by the students throughout the room. While such a set up is expensive, costing anywhere from $1,000 to $5,000, one of its outstanding features is that it allows for the projection and storage of video tapes for subsequent use by the teacher. As another alternative, a portable demonstration table can be included in the laboratory so that crowding about demonstrations at the teacher's table for a better view can be eliminated by bringing the demonstration to the students rather than vice-versa. This technique requires sufficient maneuvering room in the classroom for the demonstration table. Figure 8 shows the science instructor demonstrating an experiment

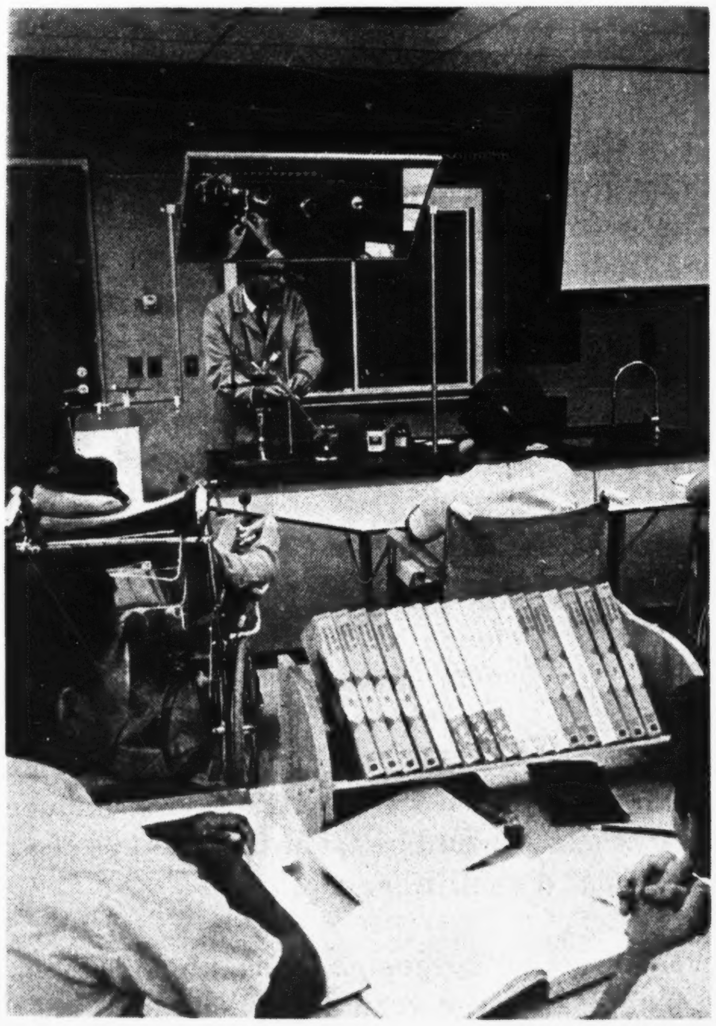

FIG. 8. Science instructor demonstrating experimental procedure. Students are viewing the lesson in the overhead pivoting mirror from their seats.

which is being viewed by the students on an overhead pivoting mirror.

The overhead projector is an item of equipment that has been extensively utilized by the science department of the Human Resources School. This machine, which has been previously mentioned as an item of general classroom equipment, can project, in color, test tube experiments which the student can watch from his desk. A microprojector, a special type of overhead projector, has a number of desirable features (Bausch & Lomb, Inc., not dated). It can allow all the students to view the same microscopic specimen simultaneously, thereby providing access to the data and information they need. In those cases in which a school cannot afford a complete set of microscopes, the microprojector is an economical means of providing the laboratory work usually dependent on individual microscopes. While the image cast by this piece of equipment is not as fine as that provided by a regular microscope it is of sufficient quality to allow students to make accurate drawings of the slide.

Since in many laboratory courses, students work in teams, science instruction could be made available to a physically disabled student by having him paired with a non-disabled partner. The student with the physical disability would be encouraged to perform as many tasks as his ability permits. This technique would involve the student with the physical disability directly in the experiment, thereby giving him a definite feeling of participation. Figure 9 shows two students working together in a science laboratory. Each student is responsible for as much of the experiment as he is capable of performing.

C. Arts and Crafts. This section will provide a brief overview of arts and crafts equipment as discussed in the educational literature and some illustrative examples of modifying this equipment for maximum utilization by disabled students, derived from the experience at Human Resources School. The review of the literature indicates that it is generally contended in educational spheres that schools with disabled students should stress instruction in arts and crafts particularly in photography, weaving and basketry, ceramics, jewelry work, and shop (Schoenbohm, 1962). If such instruction is included in the school program it is obvious that care should be taken to make use of equipment suitable for children with physical disabilities.

An example of the type of set up suggested is the photographic unit described by Schoenbohm which includes a large work room and small separate

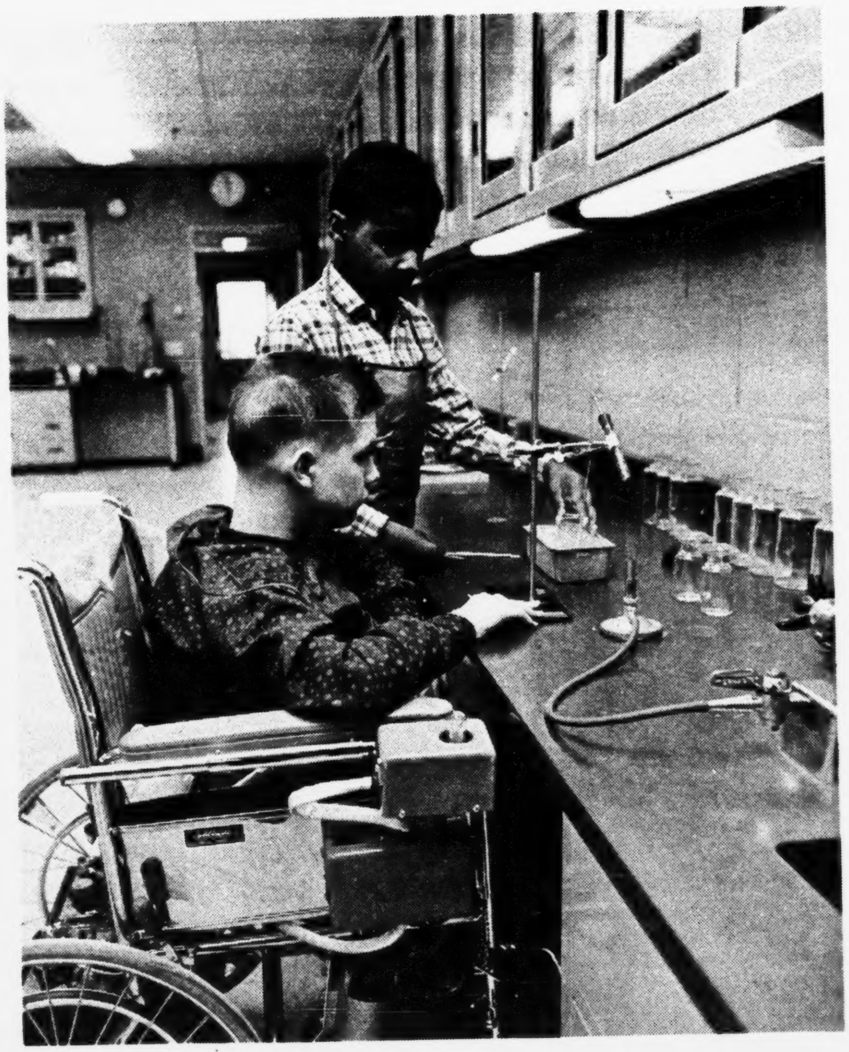

FIG. 9. Two students working together in the science laboratory. Each student is responsible for as much of the experiment as he is capable of performing.

darkroom wide enough for a wheelchair to enter and move about. Schoenbohm states that the developing tanks should be steel vertical tanks with three separate compartments and drain cocks on the bottom. The larger washroom should contain a large wooden table, foot powered printer, dryer, enlarger, ferrotype tins, metal clips, sink, trimmer, various cameras - some of the instamatic type which are easily loaded even by the severely disabled, chairs, built-in storage cabinets, file cabinets, and footboards. This equipment should be installed at heights that are suitable for wheelchair bound individuals. At Human Resources School, island sinks, centrally located and accessible from three sides with batwing faucets and gooseneck spigots have been found to be especially useful for students with orthopedic involvement. Piping should be recessed for increased accessibility and safety.

It should be noted that as lengthy as the above list of equipment may seem, all of it can be of standard design. The two year photography course offered at Human Resources School employs mostly conventional, commercially available equipment. The small core of modifications which was made refer to sinks, the dryers, the cutters, the tripods and in the case of certain disabilities, particularly muscular dystrophy, the focus and shutter mechanisms of the camera. Figure 10 shows the photography unit at Human Resources School which includes printer, dryer, enlarger and other equipment traditionally found in photographic dark rooms.

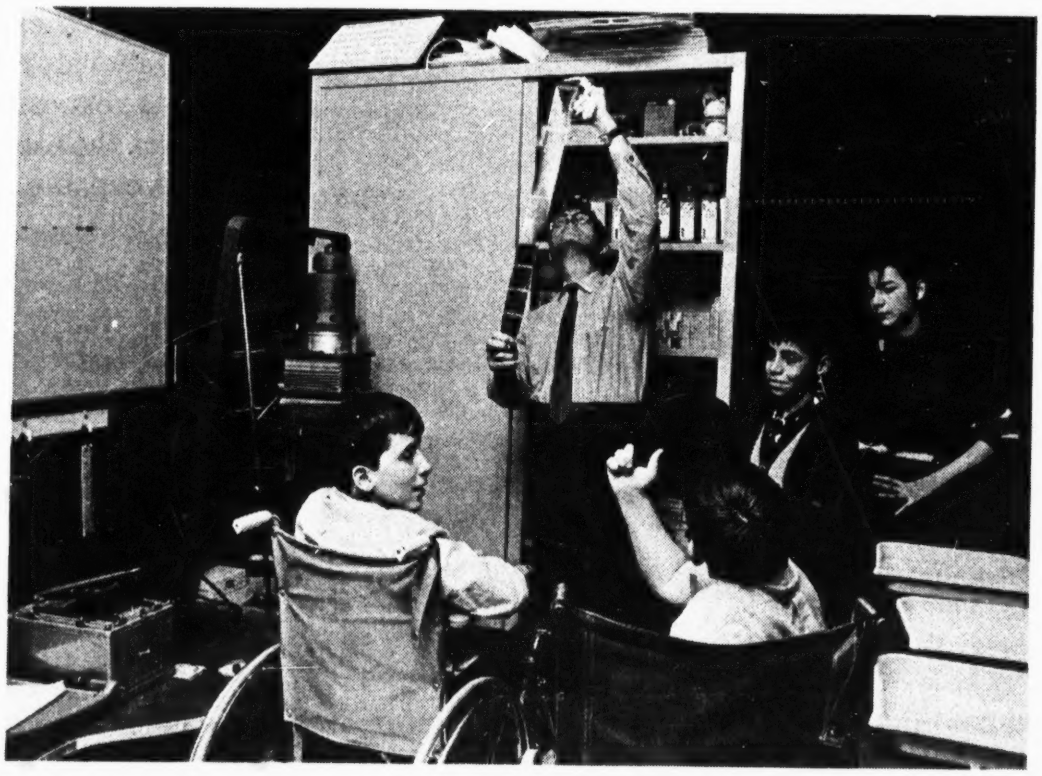

FIG. 10. Photography unit at Human Resources School includes printer, dryer, enlarger and other traditional photographic equipment.

The equipment suggested by Schoenbohm (1962) for supplying the weaving, basketry, ceramics, jewelry and shop sections include the following items: tables, chairs, built-in storage cabinets, sinks, file cabinets, work benches, etc. All items should be selected with safety in mind. The power tools should have guard devices and switches for the machines and should be easily accessible. If care is taken in selecting a craft or art activity that requires physical manipulation within the capabilities of the child's particular condition, commercially available equipment can be used extensively in the program. Figure 11 shows the arts and crafts laboratory at Human Resources School which includes a potter's wheel, kilns, display areas, etc.

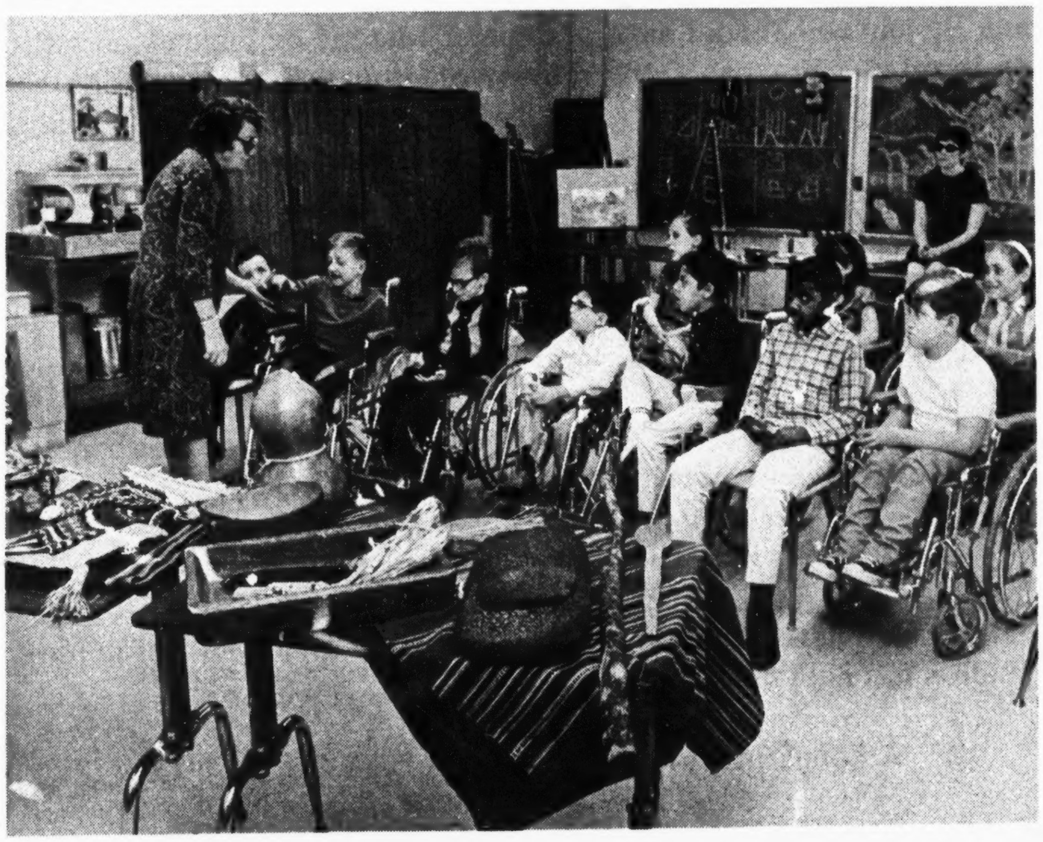

FIG. 11. Arts and crafts laboratory at Human Resources School includes potter's wheels, kilns, display areas, etc. and a large central lecture area.

It is the contention of the current authors that the arts curriculum traditionally presented to disabled students is far too restricted in terms of being both meaningful in terms of potential vocational skills and personal satisfaction. Some examples of equipment modifications which have enhanced the scope of the Human Resources School arts program will be provided here. For example, it has been found that most sculpture courts and gardens, by architechtural fault, are inaccessible to disabled students. Therefore, Human Resources School has installed a still growing instructional sculpture court adjacent to its art center. The basic adaptations related to the sculpture court refer to benches that are the height of a wheelchair seat so that students can transfer if they wish from wheelchair to bench. Benches are also sturdily constructed and have arms so that students with crutches and braces can use them independently. The sculpture pedestals are lower than usual and are about wheelchair seat heights of 19 to 20 inches so that students in wheelchairs can view them easily.

The general equipment used in the art history and exhibition areas at Human Resources School have also been adapted or purchased with disabled students in mind. For example, slide projectors, screens, slide racks and other similar equipment were redesigned to permit their use by physically disabled students. The emphasis on these modifications relate to manipulation levers and knobs which make them usable by upper extremity disabled children. In the studio-classroom area for graphics and communication design a number of modifications have been developed, some of which are for students with particular disabilities such as muscular dystrophy. Among the modifications found particularly useful in graphics and communication design are:

1) Painting easels that are free from encumbrances beneath them so that wheelchairs can approach without obstruction.

2) Potter's wheel placed on a table at desk height for wheelchairs.

3) Utensils such as chalk, crayons, and knives which have extra large handles for easy use by students with weak hands.

4) A bench level height printing press.

5) The standard "bench hook," the gripping device for the cutting of linoleum blocks was modified so that both gripping surfaces were abrasively treated. These bench hooks were manufactured in the shop of Human Resources Center. Figure 12 is a sketch of the adapted bench hook used for linoleum block cutting at Human Resources School.

6) Another adaptation in the linoleum unit was the use of a "C" clamp to hold both the linoleum block and the adapted bench hook to the work bench. This is especially useful for muscular dystrophy children and has proven to be a good safety measure for all students. Figure 13 illustrates the adapted "C" clamp used at Human Resources School.

7) In the painting and drawing areas, table top easels and pad clamps have been found most useful. In addition, the design of two "saddles"

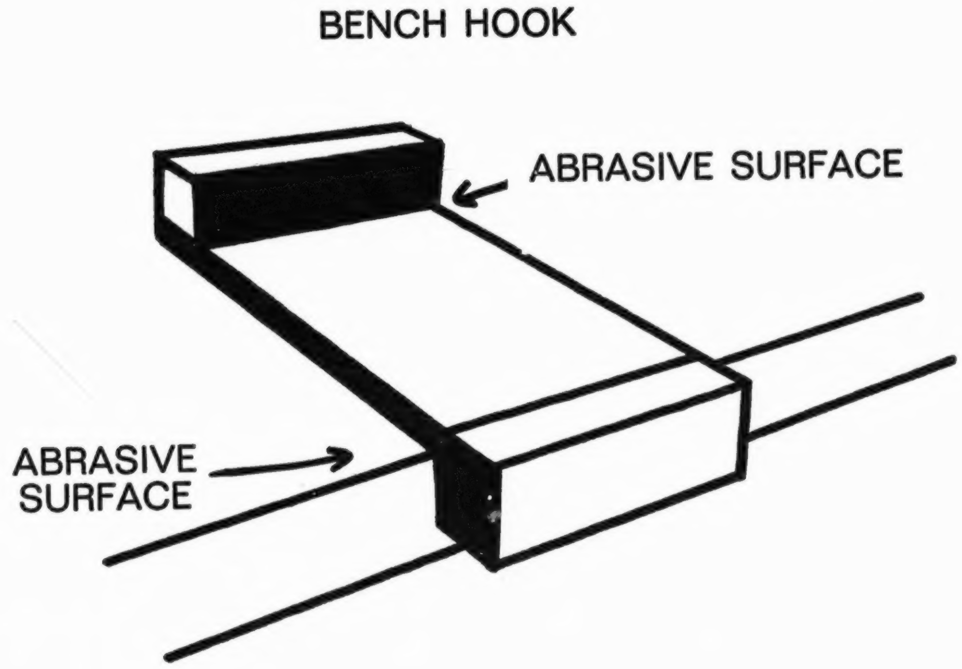

FIG. 12. Sketch of adapted bench hook used for linoleum block cutting at Human Resources School. Both gripping surfaces are abrasively treated.

or hand adapters that allow the more severely disabled students to grasp the drawing and painting instruments have been a most successful modification. As a matter of interest the design of the simpler of the two "saddles" developed at Human Resources School came about through a suggestion by one of the students and refers to what is essentially an ordinary rubber band and tube. The second "saddle" is more sophisticated and is frequently used by the most tactilely handicapped children. The more sophisticated saddle works best with dry materials, e.g., pencils and crayons. Some minimal difficulties exist when this vise is used with tempera paints. However, on several occasions, the device when used with tempera color caused a new artistic effect. Figure 14 illustrates the more complex saddle or hand adapter used at Human Resources School.

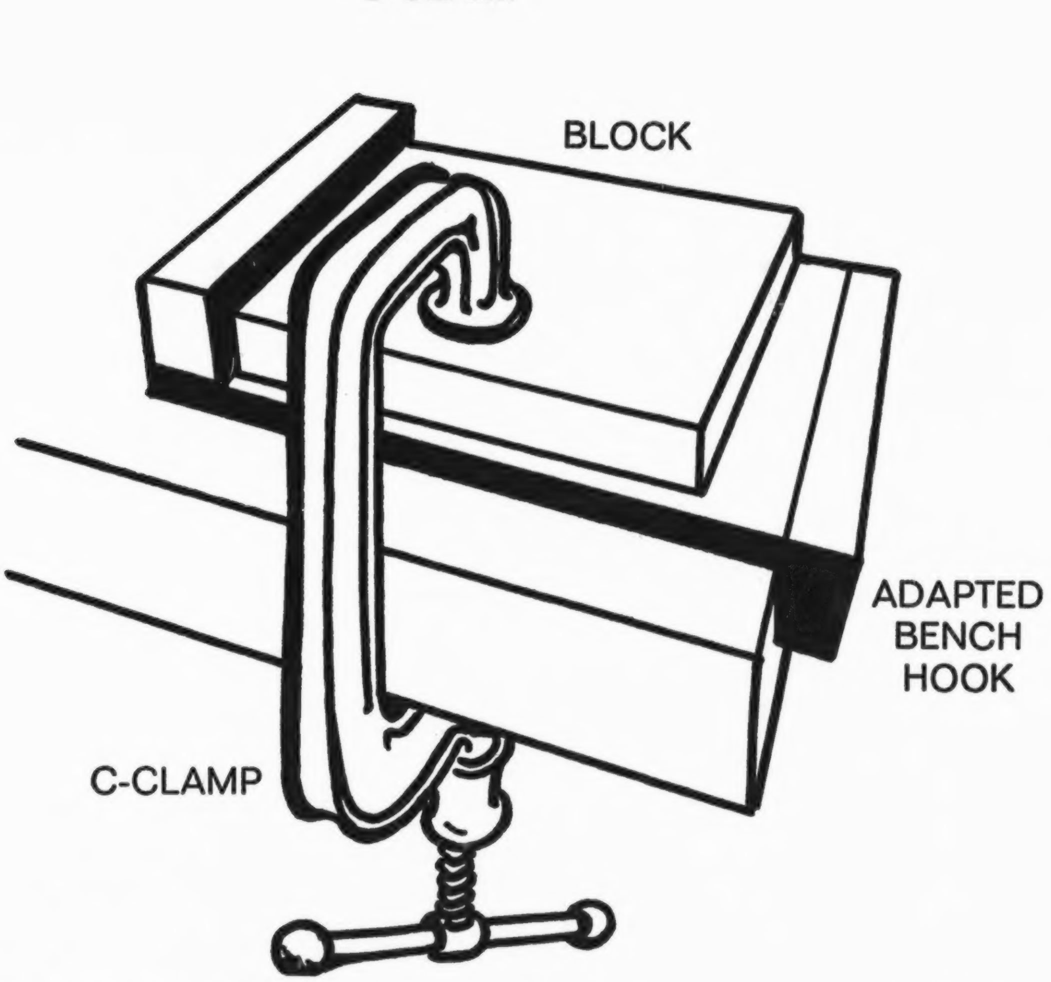

FIG. 13. Sketch of adapted "C" clamp used at Human Resources School.

Generally then, with ingenuity and with interest a number of simple modifications can be made in the equipment which will allow disabled students to partake of a more varied and exciting art program than is traditionally offered to physically disabled students. Several examples from the experience at Human Resources School have been provided as illustrations of what can be done.

For additional information on arts and crafts see London County Council (1964) and Randall (1956).

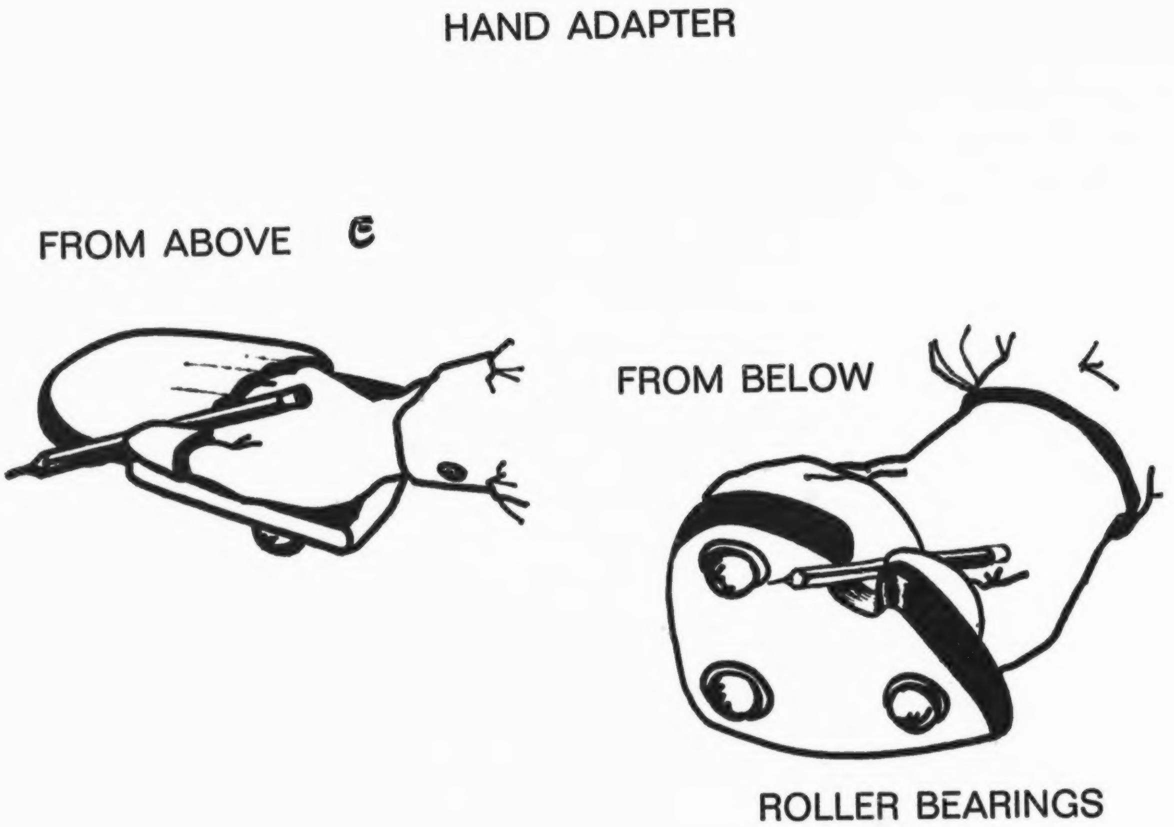

FIG. 14. Sketch of one saddle or hand adapter used for holding pencils and crayons by students with hand involvement.

D. Library and Study Room. Since the library and study rooms share the function of providing a quiet environment for students to read, study and otherwise assimilate educational materials, the equipment needs of these two areas will be considered together. The tables and chairs for both rooms should be of the type previously discussed. If the school has a number of students with hand and arm disabilities, a special piece of equipment such as an automatic page turner may be desirable. A number of models with different features are described in the publication by New York University-Bellevue Medical Center (1958). Commercially produced units are relatively expensive, starting in price at $75. For individuals whose arm or hand disabilities are not so severe that automatic page turners are needed, the publications of the American Heart Association (1965) and British Red Cross Society (1964) include descriptions of inexpensive ways of constructing page turning equipment. It has been the experience of the personnel at Human Resources School that although there are many page turners available on the market, none of these is particularly successful; additional work must be done to develop an adequate automatic page turning device.

In the library the card catalogs and dictionary stands should be placed on low bases to make them accessible to physically disabled students in wheelchairs. In libraries with a stack arrangement for book storage, the aisles between stacks should be of wheelchair width (approximately 30 inches) Although it would be desirable to place frequently used books on the shelves most easily reached by wheelchair bound students and less often used books on higher shelves, it has been found that such attempts run counter to the traditional cataloging systems used by librarians. Non-disabled students or library aides can help the child incapable of obtaining materials from the higher shelves. Figure 15 shows a student using the card catalog which has been made accessible by placing it on a low base. The dictionary stand has been similarly treated.

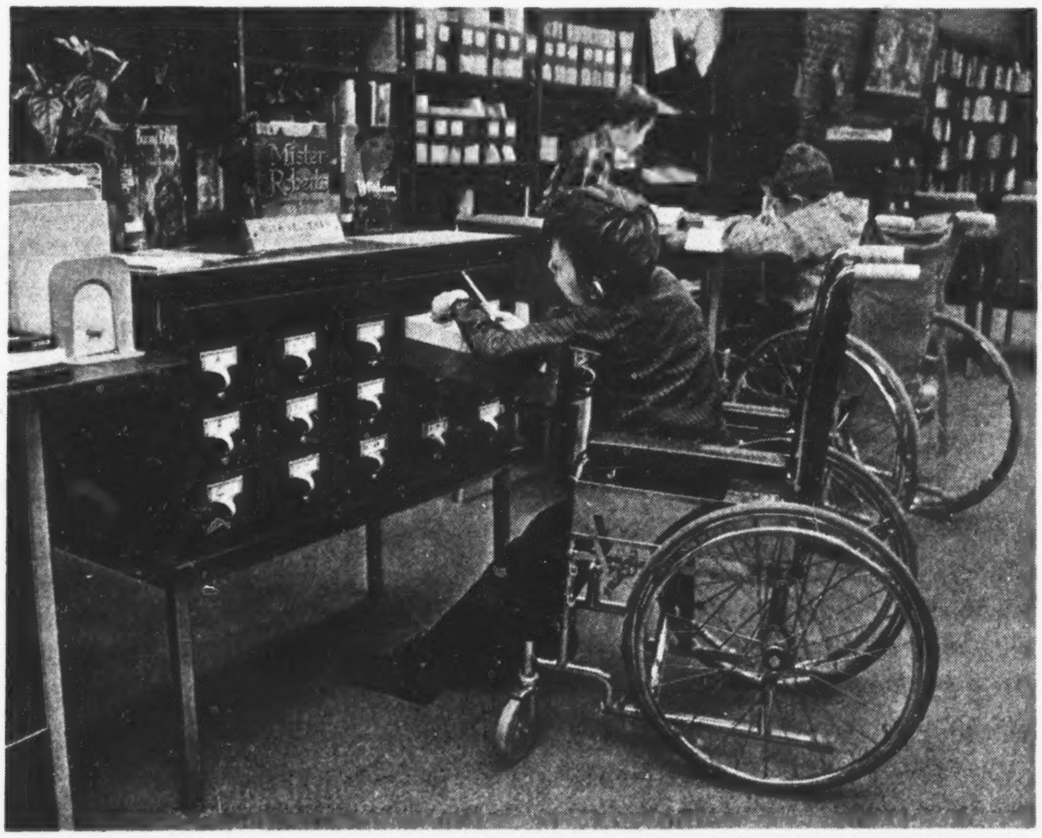

FIG. 15. Student using card catalog which has been placed on a low base to make it accessible.

In the library at Human Resources School it has been found unnecessary to place books within easy reach of the students because ambulatory peers are always on hand to help them reach materials. If the stacks are too narrow for wheelchairs, other students or library personnel can obtain the desired books, but it is important that physically disabled students have access to the card catalogs. Perimeter shelving has been utilized instead of a stack system in order to allow wheelchair students to have access to the books. The center of the room is used for seating purposes. Adequate floor space has been allowed for wheelchairs. The book collection is similar to that of other schools with the following differences. The reference section is larger than average and the reference books are circulated to a limited extent in order to serve children who cannot go to the public library. There is a large number of high interest, low vocabulary books for students with poor reading backgrounds. The fiction section is proportionately larger than average (about 1/3 rather than 1/4 of the collection) to serve the recreational reading needs of children who have little access to other reading material. For this purpose, and also for use in the curriculum, a large paperback collection is maintained. Paperback books are lightweight and thus easier, in many instances, for a disabled student to handle. In general, disabled students have the same reading interests as other children. Students are urged to use their public libraries whenever possible. A general professional educational collection includes reading materials in the field of special education. The collection of college catalogs is particularly strong in catalogs of those colleges which are equipped for disabled students. Books are supplemented by audio-visual materials which are stored and centrally cataloged in the library. These include film strips, recordings, and tapes. The DuKane Film Strip projector and synchronized phonograph (mounted within library study carrels), tape recorders, and large print books have been found particularly useful at Human Resources School. Figure 16 shows a student using a study carrel which has been equipped with audio-visual aids such as a DuKane Film Strip projector and tape recorder. Perimeter shelving is seen in the background.

For additional information on library equipment, see Metalab Equipment Company (1961), Mullen & Peterson (1965), Taylor Manufacturing Company (1963a), Velleman (1964), and Vellman (1966).

E. Auditorium. Most schools have an auditorium with a stage and fixed seats. The auditorium is most often used for both assembly purposes and for special events such as plays and concerts. In such cases, the removal of fixed seats in the front or back row(s) and reserving these areas for the physically disabled is a simple, inexpensive and safe way of making the facility available to these students. A wide side aisle can also serve in this capacity.

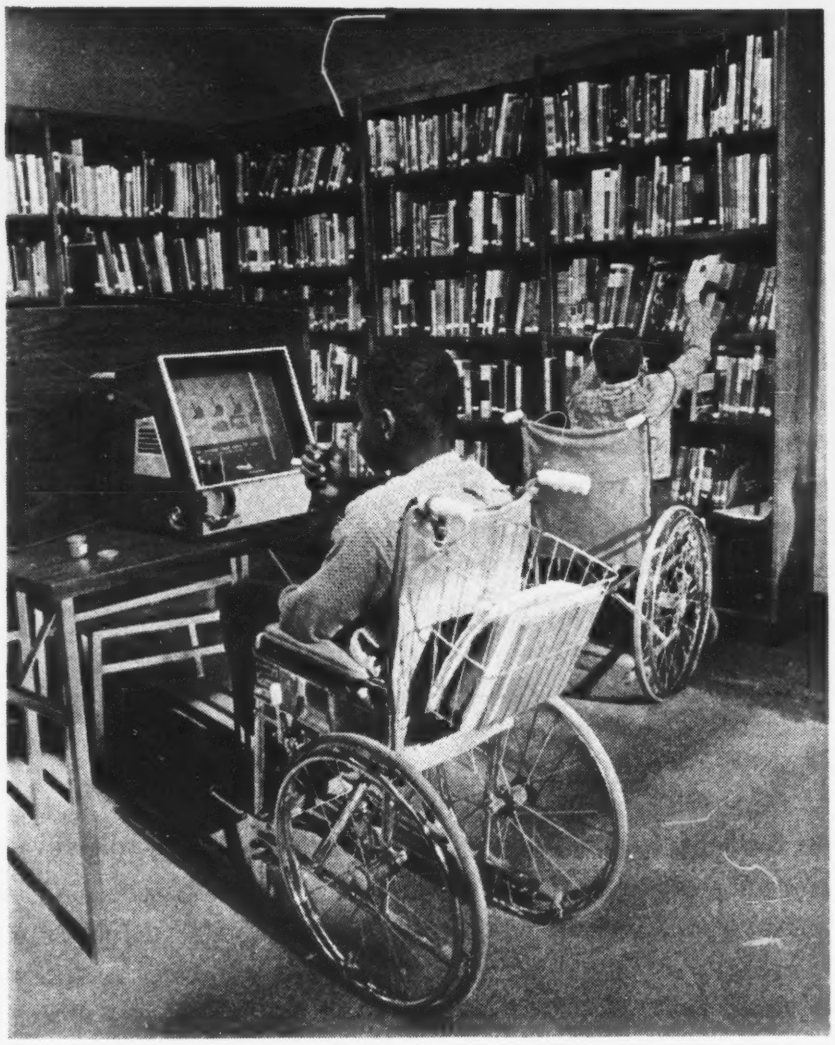

FIG. 16. Student using study carrel equipped with DuKane film strip projector. Perimeter shelving is seen in the background.

Where a multipurpose room is used, that is, a large room with a stage flat rather than sloping floor, and devoid of fixed seats, no special provisions or equipment for the physically disabled are necessary. When the room is to be used for assembly or special events students can simply wheel themselves in. Seating for the non-disabled can be provided by using lightweight chairs, which are easily stacked and stored when not in use, thereby freeing the room for other uses. An item of equipment found in the multipurpose room at the Human Resources School that has proven very useful is a large folding table manufactured by Sico Company (not dated) that can be set up and taken down by individuals in wheelchairs. These tables may be set up for quiet games, dining, seminars, etc. Figures 17, 18, and 19 illustrate three of the uses to which the multipurpose room can be put.

FIG. 17. Parent meeting in multipurpose room at Human Resources School. Chairs fold-up and are easily stored beneath the stage.

F. Greenhouse. While a greenhouse might seem to be a rather esoteric area, there are a number of reasons to consider including such a room within a school. Children with severe physical disabilities have spent a great deal of their time indoors, and therefore, have very limited experience with growing things. Non-disabled as well as disabled children from large metropolitan areas in all likelihood have had little contact with plant life and vegetation. A greenhouse could be an enriching experience under these circumstances.

The greenhouse, which is part of the science complex at the Human Resources School, has been designed so that the children can see and study nature in addition to conducting their own experiments in growing and caring

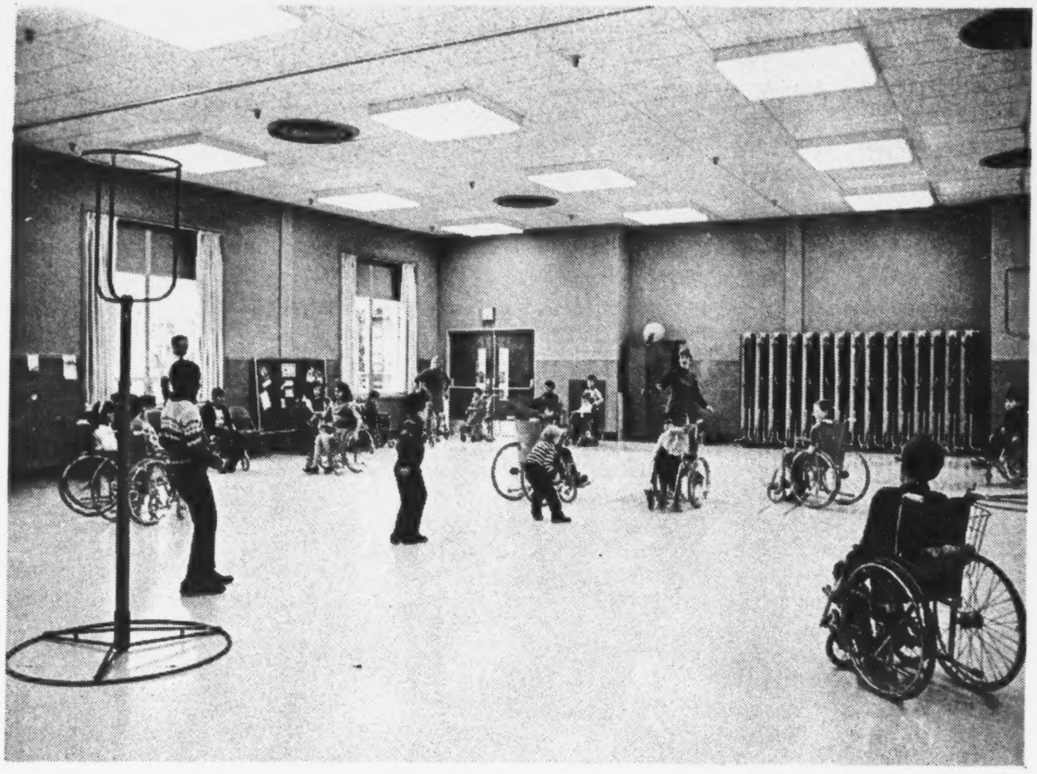

FIG. 18. Multipurpose room is used for indoor physical education at Human Resources School. Sico tables are stored in alcove against back wall.

for plant life. It is bounded by the science laboratory, the home economics room, and the library. Each room shares a fully insulated thermoglass wall with the greenhouse which allows a full view of the plants, etc. Sunlight from the roof of the greenhouse, which opens and closes automatically under the control of an automatic temperature-humidity register, is made available to these three rooms.

The greenhouse is equipped with specially designed planting benches consisting of free-form sections at wheelchair height with clear space beneath the benches. These durable fiberglass benches were necessary because commercially available planting benches were found to be inflexible in design and took up too much aisle and maneuvering space when grouped. Soil storage bins, also of fiberglass, sit on the planters and can be slid to wherever the soil is needed. The greenhouse floor is constructed of easily maintained quarry tile.

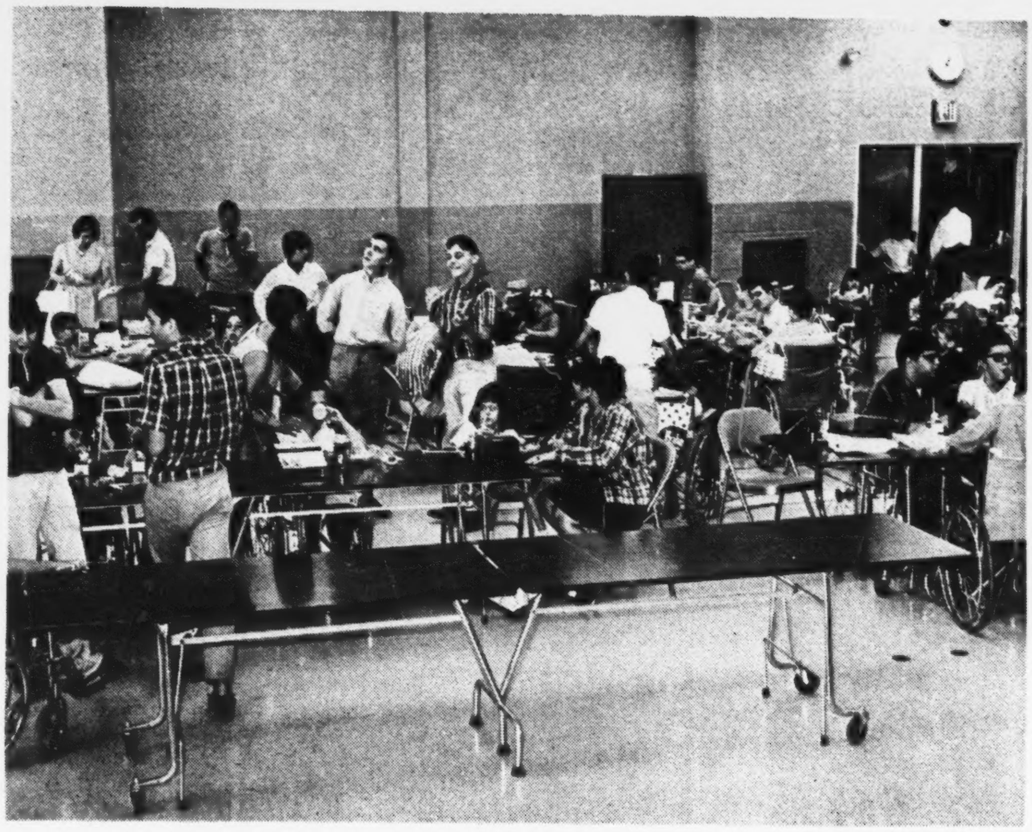

FIG. 19. Multipurpose room set up for lunch using adjustable tables.

The greenhouse can be entered from two sides and the aisle space is wide enough so that students in wheelchairs can move back and forth or turn around with ease. Figure 20 shows the greenhouse at Human Resources School with free-form planting benches which allow adequate maneuvering space for students in wheelchairs.

G. Cafeteria. Since dining halls provide an opportunity for students to socialize as well as to eat, every effort should be made to enable students with disabilities to avail themselves of these facilities. Tables in the cafeteria should be high enough to accommodate wheelchairs. According to Schoenbohm (1962), the aim should be to help children to eat in as normal a fashion as possible. Special aids should be utilized only in those cases where they are absolutely essential for the ingestion of food.

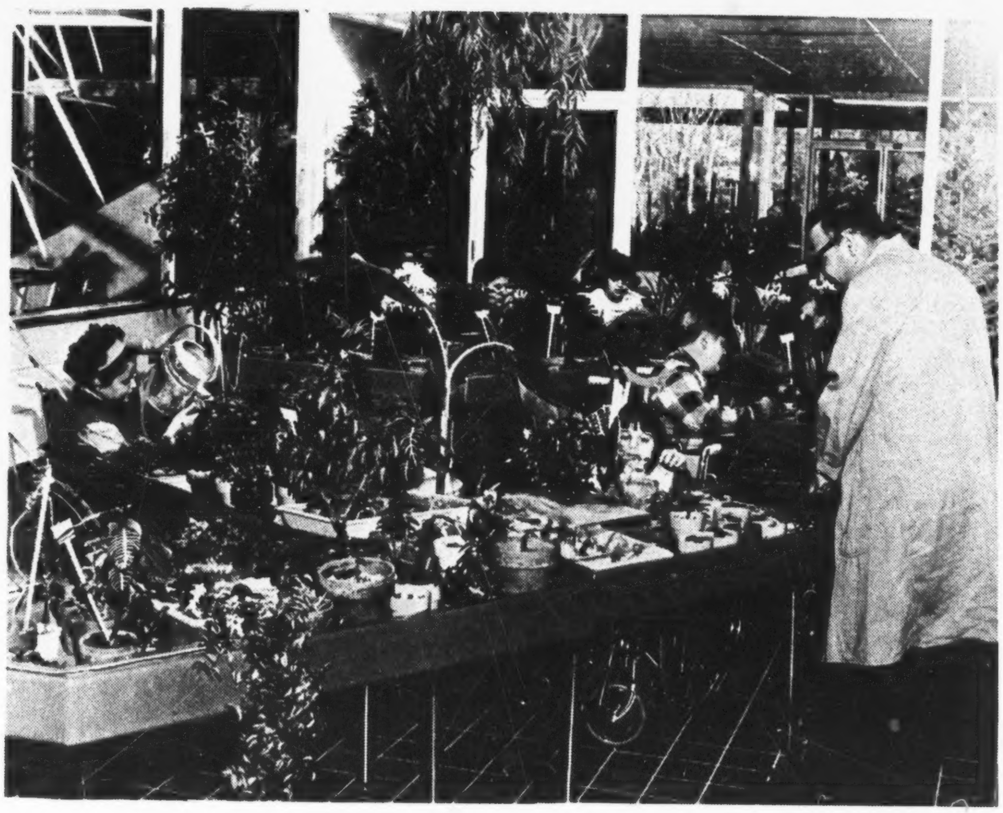

FIG. 20. Greenhouse at Human Resources School with free form planting benches which allow maneuvering space for wheelchair bound students.

Where necessary, Schoenbohm recommends the following special feeding devices: feeding boards, suction cups and plates, special spoons, knives and forks, straws with corrugated necks or plastic tubing, two-handled cups with small drinking holders and feeding tables. Moore (1957 & 1958) has published two directories of commercially available adaptive eating equipment and supplies and descriptions and sources of these aids. Her 1958 directory also evaluates the items included. Additional sources of adapted eating equipment as well as ways to adapt regular utensils are found in the American Heart Association (1965) and the British Red Cross Society (1964) guides, and in Re-adaptation (1965), and Rosenberg (1965). The aids presented include such items as rocker knives for one-handed persons, knives, forks, and spoons with special grips for a variety of disabilities, combined knife and fork, no hands self-feeder, suction grips for plates, and a number of drinking accessories.

For information regarding standard cafeteria equipment, see Lincoln Manufacturing Corporation (not dated).

H. Gymnasium. A current trend in physical education for the physically disabled is to adapt a program of activities to the particular needs of the individuals rather than to adapt the facilities or equipment. Daniels & Davies (1965) suggest:

> Whenever feasible, students in the adapted program should use the facilities and equipment available in the general program. This is in line with the policy of reducing "differences." Although handicapped students may, and do, require special facilities and equipment, the goal is to get them to the place where they can profit from and enjoy standard facilities, equipment, and activities.... the belief is held that the adapted program is the broadest application of general physical education in meeting the needs of handicapped students, and ... regular facilities and equipment can and should be a major factor in the program (pp. 369-370).

It is of interest to note that the design of physical education facilities for disabled students has been largely neglected or cursorily passed over. In one small study conducted at Human Resources Center in 1966 in which 30 special education sources were reviewed, it was found that 50 percent made no mention of providing facilities or equipment; 20 percent discussed facilities for physical therapy and rehabilitation training only; the balance discussed equipment and program requirements only.

Daniels (1954) recognizes a need for special facilities and equipment only for one phase of a physical education program; special exercises and functional training. He suggests placing training equipment in a special room or in an auxiliary gym. From the experience at Human Resources School it appears that segregation of physical education and physical therapy (the two aspects of an adapted physical education program) is self defeating since the goal of adapted physical education is the integration of these two factors.

In spite of the foregoing, some minor equipment modifications may facilitate presentation of the physical education program. In general, modifications refer to using equipment which children with even limited strength and dexterity can manipulate. Further, most equipment suggested for use by disabled students is commercially available. For example, lightweight aluminum shuffleboard cues may be used in place of the standard wooden cues since the former are considerably lighter and more easily manipulated by students with physical disabilities. Standard whiffleballs may be used to replace the more traditional hard-core softball. Whiffleballs are lighter and easier to use and are safer should a student be hit by the ball. Plastic baseball bats may be used in conjunction with the whiffleballs when playing softball games indoors.

A guiding principle in providing an adapted physical education program is to select as many activities as possible in which the children may participate with a minimum of modification. This may be accomplished by choosing equipment which is flexible enough to meet the needs of students with a variety of disabilities as well as non-disabled students. An example of equipment which fulfills these considerations is a basketball backboard with set back supporting posts and height adjustment capability. These features are advantageous in that they may be used by both ambulatory and semi-ambulatory students, younger and older students, etc. This equipment is also safer than the traditional basketball gear insofar as collisions with the supporting posts are less likely to occur. Similarly, the selection of a net that is adjustable in terms of height enables a wide variety of net games to be included in the physical education program. For example, one net could be used for badminton, volley ball, etc.

Certain sports require very specific equipment modifications. One example of what can be done is the development of a bowling ramp at Human Resources Center which enables even the most severely disabled student to bowl with ease. An alternative to the use of this special bowling ramp is a commercially available item called a bowl-a-cue. (Nemar Products, not dated) Figure 21 illustrates the bowling alley at Human Resources Center. The portable ramp allows even the most severely disabled student to participate in this sport.

Some thought should also be given to those students whose dexterity and strength are so limited that they are restricted to primarily inactive games such as chess, checkers, etc. In these cases, simple devices such as a head band with a stick attached to it, comparable to the device described for typing, may be used.

In general, the scope of physical education programs is limited only by the ingenuity and interest of the program director. It has been found at Human Resources School that many disabled children may engage in almost every activity available to non-disabled students with only minor modifications of equipment or rules or both. Many physical education modifications are described in detail in the monograph dealing with curriculum and instructional techniques, Human Resources Study No. 12.

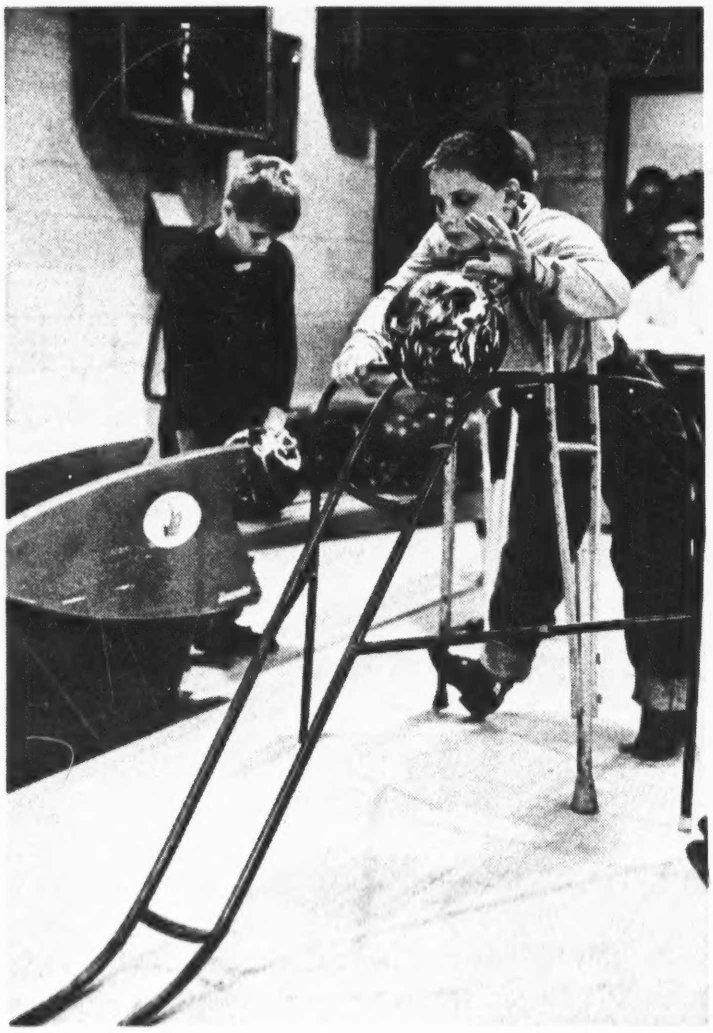

FIG. 21. Student bowling with portable ramp developed at Human Resources Center. This device allows even the most severely disabled to bowl.

For additional information about gymnasium equipment, see Ball-Boy Company, Inc. (not dated), Chapman (1960), Human Resources School (1967), Hunt (1955), Mathews, Kruse, and Shaw (1962), National Recreation Association (1965), and Pomeroy (1964).

I. Home Economics. A home economics room could be left completely unmodified. Ideally, however, it should contain an adapted kitchen, such as the one described by McCullough and Farnham (1961) for persons in wheelchairs. This kitchen has such features as a lowered sink, recessed pipes, low range and broiler placement, low storage cabinets, special grip mixing bowl arrangements, etc. It should be noted that all of this equipment is standard and commercially available; the major concessions for use by physically disabled individuals being in arrangement of work areas, height, and general accessibility. Since disabled students may eventually have to function in an environment that has not been adapted for them, a useful contrast is provided by having the laboratory contain a regular kitchen with appliances duplicating the adapted kitchen, but arranged exactly as they would be found in an average home or apartment. This would enable students to develop their skills on adapted equipment before applying them to the more usual type of equipment they are likely to encounter. It allows the instructor to point out dangers and hazards in conventional arrangements of equipment and thus promote safety consciousness in the students. It is interesting to note that the non-disabled housewife working in the adapted kitchen would be able to sit while she performs various tasks, thus reducing energy expenditure.

Many physically disabled children require instruction in how to perform presumably simple activities that are part of one's daily life. These activities may be related to home maintenance (cooking, cleaning, etc.) as well as to personal self-care (grooming, bathing, etc.). If these Activities of Daily Living (ADL) are to be included in the curriculum, a comprehensive description and listing of the furniture and equipment necessary for an ADL room can be obtained from Chapters 8 and 9 of Lawton's Activities of Daily Living for Physical Rehabilitation (1963). These chapters provide an outline of detailed specifications for furnishing an ADL room in a minimum of space. Commercially available furniture is discussed as well as special equipment needed for an ADL room consisting in particular of a bedroom area and a bathroom area.

Keeping these general considerations in mind, several illustrative examples based on the experience at Human Resources School will demonstrate how a Laboratory for Everyday Living may be equipped. The Laboratory for Everyday Living was initially planned for use by small groups of students working on a variety of projects during each class session. For this reason the room is divided into areas including sewing station, a laundry and clothing maintenance unit, bathroom facilities, a totally adapted kitchen, one semi-adapted kitchen, and a bedroom arrangement. All of the equipment used is standard and commercially available; the major adaptations for physically disabled students involve only arrangement of work areas, height and general accessibility, mentioned above.

The sewing area contains wheelchair height counter space with shallow sliding door cabinets for storage of sewing project materials. A movable formica table with adjustable legs contains two drop leaf sewing machine receptacles and provides work space for cutting patterns. This table also provides additional table space for other home economic activities when the sewing machines are closed.

The laundry and clothing maintenance area contains a Westinghouse washer and dryer unit complete with a sink and built-in ironing board. This unit was selected due to the front loading feature of both the washer and dryer and the front dial arrangement for ease of operation by those in wheelchairs. Figure 22 shows the Laboratory for Everyday Living at Human Resources School with adapted and semi-adapted kitchens, sewing, and laundry areas.

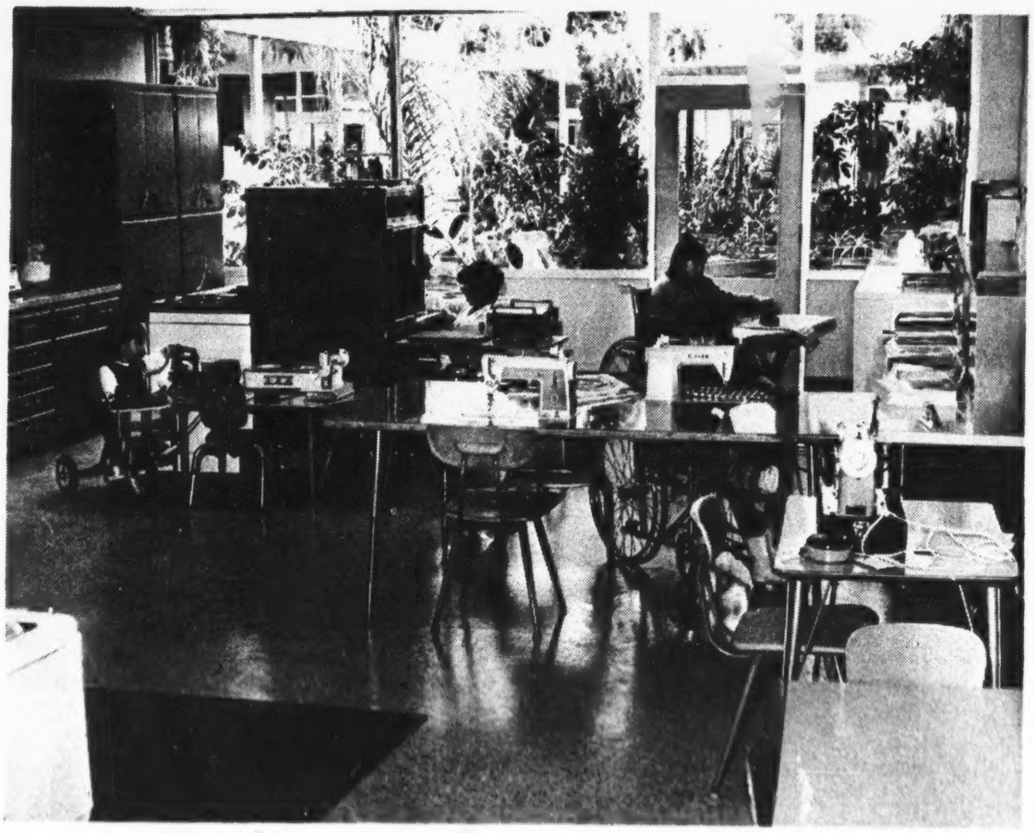

FIG. 22. The Laboratory for Everyday Living at Human Resources School. Notice the semi-adapted kitchen in the background. Sewing and laundry areas are illustrated as well.

The adapted kitchen features a lowered sink, recessed pipes, an electric oven with a vertical swinging door and a counter top electric range with dials set in front immediately under the range so that the individual does not have to reach over the cooking surface. The second kitchen area features a gas range with dials set on the front surface, dishwasher, sink, refrigerator and work surface, arranged as they would be found in an average apartment. The student first learns the basic skills of cooking and food management in the adapted kitchen. Assistance is then offered to each student to determine what minor adaptations, gadgets and techniques might facilitate the individual's use of an average kitchen. Figure 23 shows the adapted kitchen at Human Resources School.

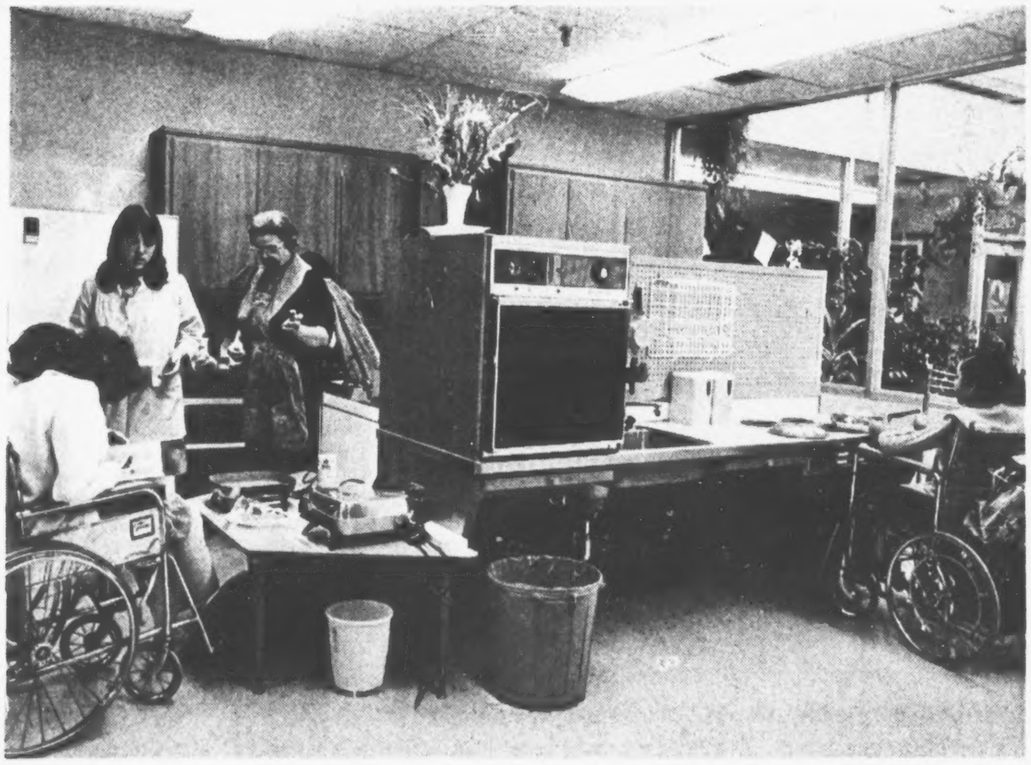

FIG. 23. View of adapted kitchen at Human Resources School. Notice the work space provided beneath each of the major appliances and the recessed piping as well as the counter space available.

In addition to the commercially available equipment useful in ADL and home economics training, there are a number of modifications which can be made by the school which might prove useful. For example, use of a mobile demonstration table with overhead mirror comparable to that described in the section on the Science Laboratory above, would greatly facilitate the presentation of curricular material. In lieu of such a table the demonstration surface might be the top of a mobile cart which could be moved from student to student and also allow for storage of kitchen utensils.

Some of the adaptations which have been found most successful at Human Resources School include use of a cutting board mounted on suction cups so that students with only one functioning hand or with minimal strength would not have to be concerned with holding the board steady. Similarly, a large screw protruding through the top of the cutting board could be used to impale potatoes, apples, etc. and would simplify peeling. One severely involved student who could not use the knee lever on a sewing machine was fitted with a neck control mounted on a chin bit by which she could depress the control lever of the machine. In addition, there are a number of common sense modifications such as use of an electric scissors for students with minimal motor control, placement of a lightweight sewing machine on a tray fitted over the arms of a wheelchair, and simple handles rather than knobs on cabinets for amputees with prostheses. Figure 24 illustrates the cutting board with suction cups and peeling screw developed at Human Resources School.

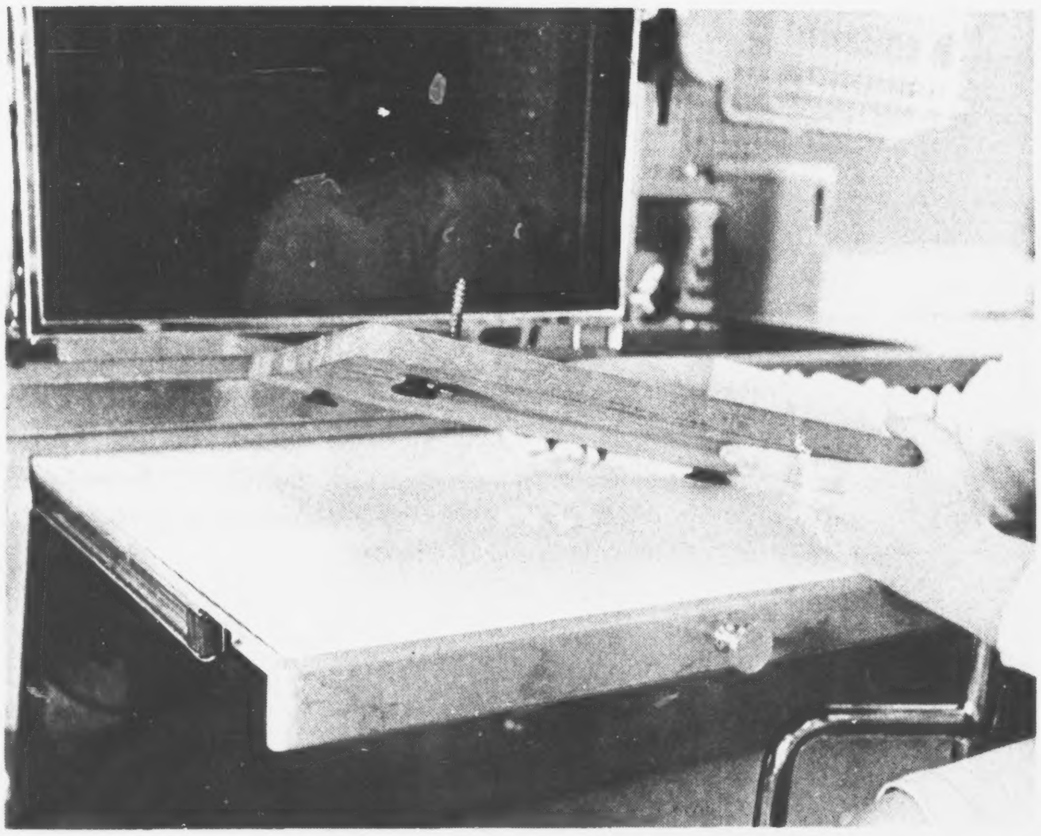

FIG. 24. Cutting board with suction cups and peeling screw. These modifications provide secure mountings which enable students with the use of only one hand to work comfortably.

A grocer's hook facilitates reaching many small items without the student's getting out of his wheelchair. A Ronson can opener features one-hand operation. For students who cannot grasp the hose of a tank type vacuum cleaner, a small door handle may be attached to the hose. In addition, the tank may be adapted with a tall vertical handle and a cord holder, and an "L" shaped extension for connecting the hose to the tank to eliminate the need for bending down. An electric mixer may be used instead of a manual mixer and a lever control may be installed instead of the dial type speed control found on most machines. It might also be noted that in providing the children with practice in dressing themselves independently, a three-way mirror is most useful. Figure 25 shows a student using the grocer's hook to reach high shelves, and

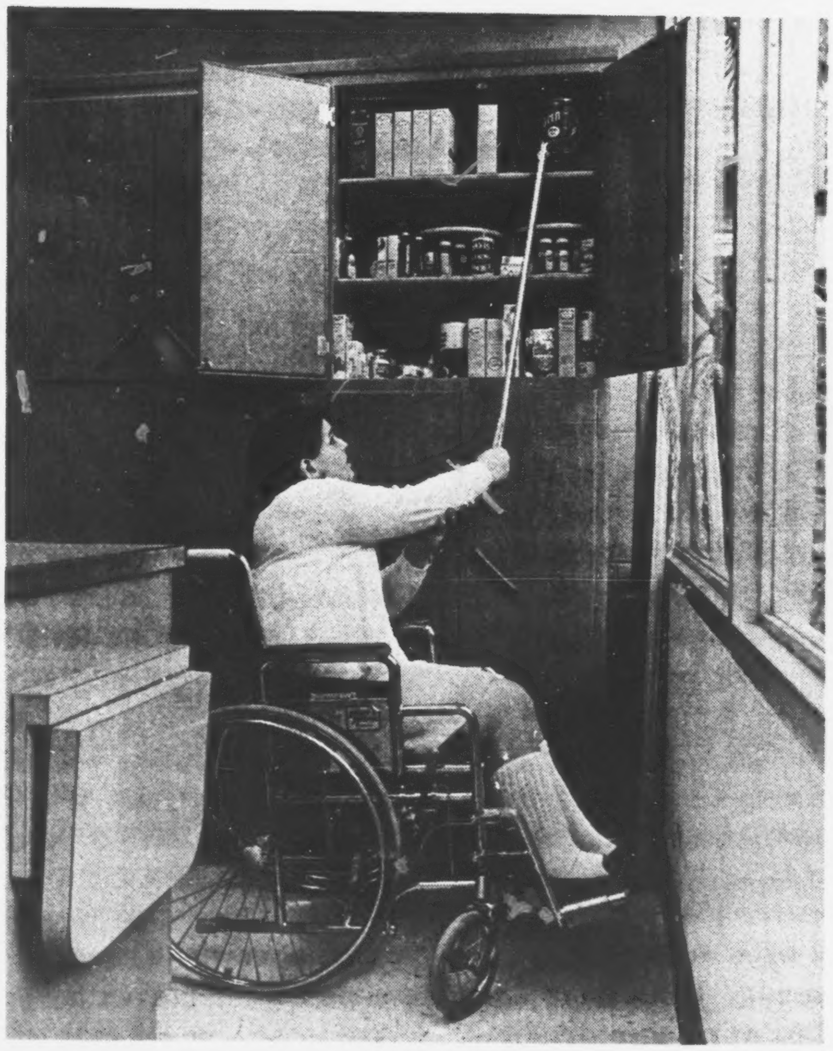

FIG. 25. Use of a grocer's hook allows wheelchair bound students to reach otherwise inaccessible objects.

Figure 26 pictures the use of the adapted vacuum cleaner.

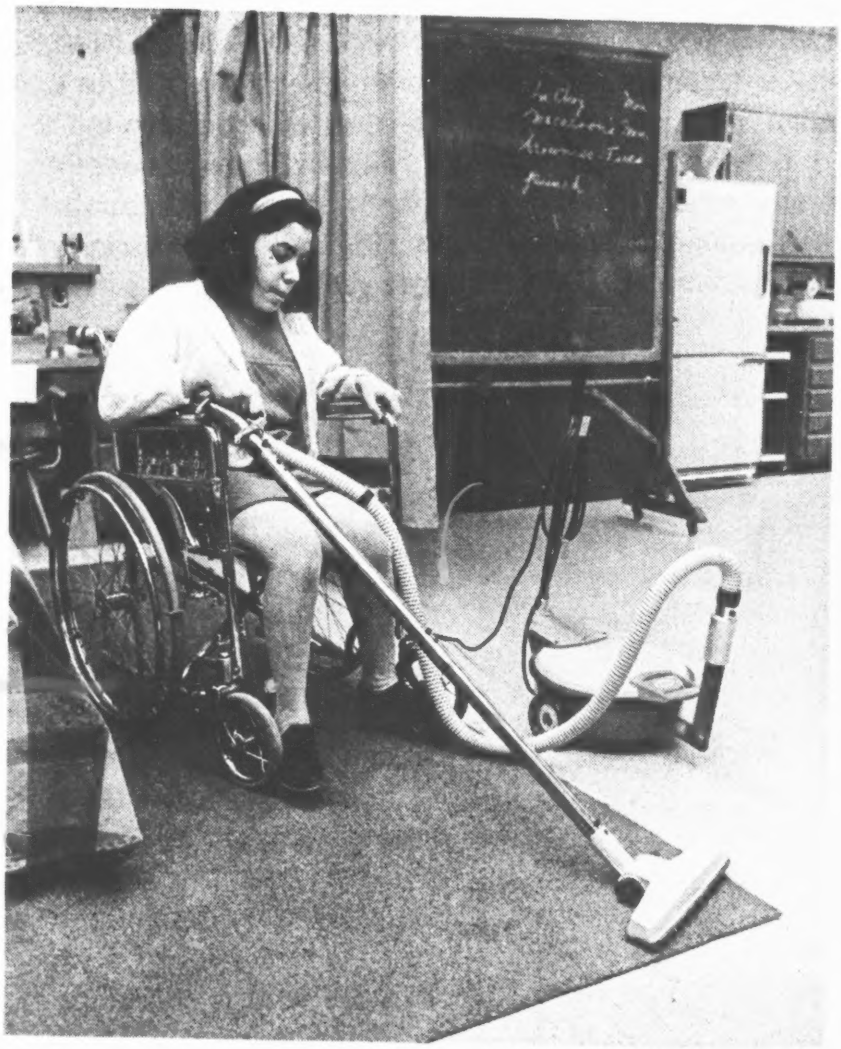

FIG. 26. The adapted vacuum cleaner developed at Human Resources School allows even severely upper extremity involved students to use this machine.

For additional information on equipment for home economics and ADL training, see Agerholm (1961), American Heart Association (1965), B/K Sales Company (not dated), Bare, Boettke, and Waggoner (1962), Beneke Corporation (not dated), British Red Cross Society (1964), Central Council for the Disabled (not dated), Liston (1965), London County Council (1964), May (1961), May, Waggoner, and Boettke (1967), National Society for Crippled Children and Adults (1965), Nugent (1966), Rehabilitation Record (1963 & 1964), Rosenberg (1965), Taylor Manufacturing Company (1963b), U. S. Department of Agriculture (1964), Wheeler (1962), Wigfield (1957).

As may be noted from all of the foregoing there are considerable differences of opinion regarding whether the educational process for physically disabled students may be facilitated by the use of extensive gadgetry. It is the contention of the present authors that the guiding dictum in selecting and using equipment should be: DO NOT CHANGE WHAT DOES NOT HAVE TO BE CHANGED. It is believed that the transition from the special environment created in the school setting will be made more difficult by extensive use of specially modified and adapted equipment. However, the student's learning should never be impeded by the lack of suitable equipment; careful judgment should be exercised in the selection and utilization of educational equipment. Figure 27 illustrates a simple modification which enables students to transport their books in a small

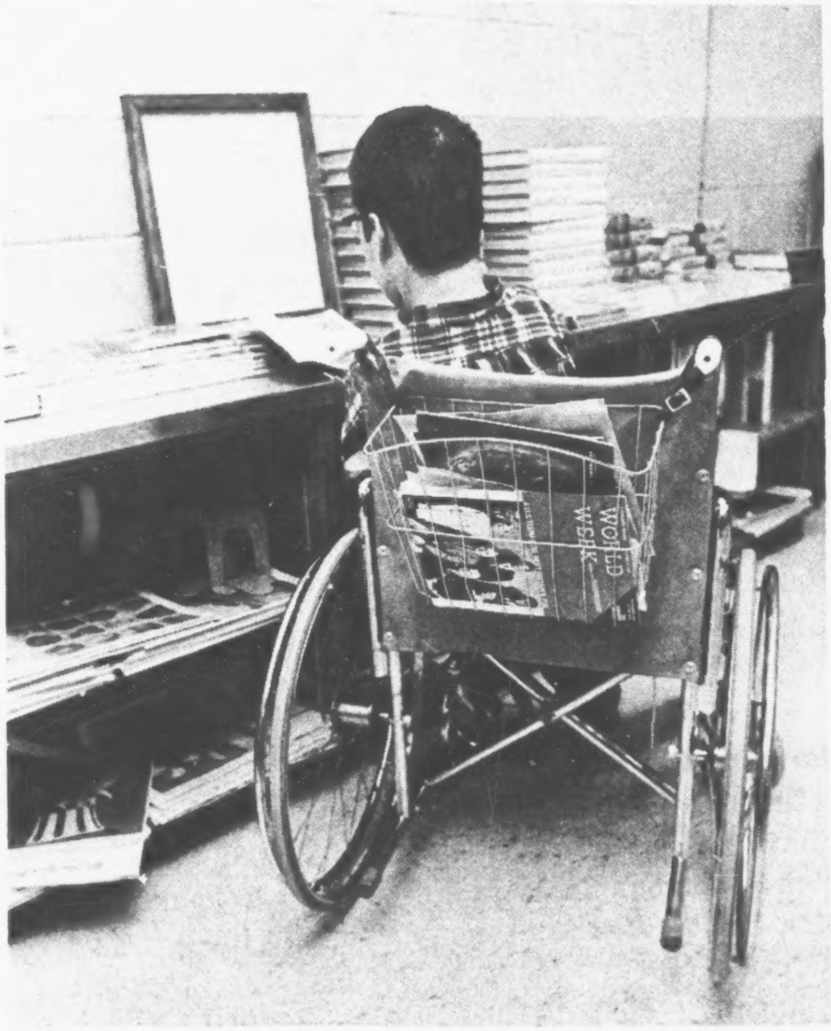

FIG. 27. This simple adaptation of inexpensive commercially available equipment enables wheelchair bound students to carry their books with them from class to class and from home to school.

basket behind the wheelchair. This is a good example of the fact that simple and inexpensive modifications using commercially available equipment may facilitate the education of physically disabled students.

For additional references of general interest relating to school equipment suitable in schools for disabled children, see Abbatt (1966), Central Council for the Disabled (not dated), Connor (1958), Connor and Goldberg (1959), Dorwood (1960), Human Resources Center (1966), Illinois, State of (1961), London County Council (1964), National Society for Crippled Children and Adults (1965), Olshin (1967), Rosenberg (1965), Ross (1966), Rusk and Taylor (1953), Russell (not dated), Sigma Signs (published yearly), Spastic Centre, The (not dated), Stoddard and Gore (1959), Toomey j Gazette (published semi-annually), Watt (1966), and Winnower, The (published quarterly).

SUMMARY

The present monograph contains discussions of the various items of school equipment that serve as barriers to the proper education of disabled individuals. By careful thought and analysis, equipment can be selected that can be profitably used by disabled children. If suitable equipment is not commercially available, it may be necessary to modify the equipment, or, occasionally, even to prepare specially adapted, made-to-order equipment. In the selection and modification of equipment, instructional quality and effectiveness should be the prime consideration, with economy and maximum utility being important subsidiary concerns.

The first section of the monograph contains discussions of the furniture and equipment appropriate for use in schools where there are disabled children. The topics discussed include tables and desks, bookcases and storage cabinets, chalkboards, audio-visual aids, communication aids, and mobility and postural equipment. While there are specific points to be made with respect to some of these items, there are basic underlying considerations that apply to all of them. In selecting furniture and equipment for use by disabled persons, questions such as the following should be asked: 1) Is the equipment of an appropriate height, or can the height be adjusted? Because some disabled children are in wheelchairs and cannot stand up, the height of desks, shelves, cabinets, etc. are of primary importance. 2) Has provision been made for each student in the class to see what is going on with a minimum of moving about? The use of appropriate projection equipment, mirrors, and audio-visual aids can greatly facilitate communication with a minimum of student mobility being required. 3) Is the equipment arranged so that a student in a wheelchair can get to it? Chalkboards that are flush against the wall and tables that a person in a wheel chair cannot wheel under provide barriers. 4) Is there special equipment that the student can use at his desk that will make it possible for him to carry out his tasks? Equipment such as electric typewriters, tape recorders, or special chalkboards can often be used to facilitate the education of a child with limited physical capabilities. 5) Is the school concerned with making special equipment available to facilitate the student's mobility? Some schools provide wheel chairs, litters, etc. for their students while others require the students to provide their own mobility equipment.

The above considerations apply not only to the classrooms, but to the specific educational areas as well. Care must be taken to see that all areas, including the laboratories, library, cafeteria, auditorium, and gymnasium are suitably equipped. In each of these rooms consideration should be given to the height of the equipment and whether a wheelchair fits under it. In each case the items of equipment should be far enough from one another so that wheel chairs can move between them. There should be provision of audio-visual aids and overhead mirrors to facilitate vision from all parts of the room.

In some areas there are other specific requirements. The auditorium should not have steps either leading to it, or in it. There should be a ramp leading to the stage, and auditorium space should be provided for students to sit in their wheelchairs. The gymnasium should have the usual equipment since the current emphasis is on adapting the program of activities to the disabled individual, rather than adapting the physical facilities per se. Despite this, some modified equipment can be used for those persons with limited strength and dexterity. Under ideal conditions, home economics rooms should provide two complete sets of equipment; one set that is completely unmodified, the other completely modified for optimum use by a person in a wheelchair.

These suggestions are intended to serve as guidelines for providing equipment for disabled students in schools. Many other ideas are presented in the literature, and productive thinking should always be used in any attempt to solve these problems.

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APPENDIX

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Miss Alice Brandt
Principal
Cameron School
El Cerrito, California

Mr. William Brickel
United Cerebral Palsy of Kansas
Wichita, Kansas

Dr. Hobert Burns
Academic Vice President
San Jose State College
San Jose, California

Dr. Dorothy B. Carr
Supervisor of Schools and Programs
for Crippled and Delicate
Los Angeles City School District
Los Angeles, California

Mr. Carl J. Carter
Principal
Charles A. Whitton School
Oakland, California

Mr. Ralph Cline
Principal
Nina Harris School
Pinellas Park, Florida

Mr. Robert Dennis
United Cerebral Palsy of Kansas
Wichita, Kansas

Professor Chris J. DeProspo
Professor of Education
School of Education
City College of New York
New York, New York

Miss Helen Desort
Principal
Skyline High School
Oakland, California

Mr. Paul DeVivo
Counselor
Kansas State Teachers College
Emporia, Kansas

Mrs. Jennie Elenbaas
Principal
Thompson School for Orthopedically
Handicapped Children
Elmonte, California

Miss Elizabeth A. Ferris
Counselor
Physically Disabled Students Office
Division of Student Personnel
Wayne State University
Detroit, Michigan

Dr. Gibb Fink
Rehabilitation-Education Services
University of Illinois
Champaign, Illinois

Mrs. Helen Friedman
Guidance Department
A. Harry Moore School
Jersey City, New Jersey

Mr. Selwyn Goldsmith
Architect
City Architect's Department
City Hall
Norwich, England

Mrs. Beatrice Gore
Consultant in Education of Physically Handicapped Children
State Department of Education
Bureau of Physically Exceptional Children
Los Angeles, California

Mr. Louis Gottlieb
Editor-Publisher of the Journal SACcess
So. Miami, Florida

Dr. Dwayne F. Hetlinger
Professor of Education
Division of Guidance & Counseling
Kansas State Teachers College
Emporia, Kansas

Mr. Max Hofmeister
Regional Director
Florida Division of Vocational Rehabilitation
Tampa-St. Petersburg, Florida

Mr. Jack Jonas
Executive Director
United Cerebral Palsy of Kansas
Wichita, Kansas

Mrs. Elizabeth Katzman
Institute for Crippled & Disabled
New York, New York

Mrs. M. L. Kellmer-Pringle
Director
National Bureau for Cooperation in Child Care
London, England

Mr. Alan R. Logan
Chairman
State of Florida Governor's Committee on the Employment of the Handicapped and Executive Director, Society for Accessible Construction
St. Petersburg, Florida

Mr. Emil Lombardi
Principal
Roosevelt Cerebral Palsy Center
Roosevelt, L. I., New York

Mrs. Esther McLachlen
Principal
Love Grove School
Jacksonville, Florida

Mr. Walter Matheny
Director of Matheny School
Peapack, New Jersey

Mr. William Cooper Mathews
Principal
Forest Park School
Orlando, Florida

Dr. John Milton
Athletic Director
Kansas State Teachers College
Emporia, Kansas

Mr. Richard Mitchell
Principal
Fremont Older School
Orthopedic Unit
Cupertino, California

Mr. John Moorhead
Principal
Washington School of Physically Handicapped
Sacramento, California

Dr. Harold Morine
Associate Professor of Education
Hofstra University
Hempstead, New York

Dr. Edward Murphy
Superintendent of Schools
Syosset Public Schools
Syosset, New York

Dr. William R. Nachtman
Principal
Newcastle School for Exceptional Children and Director of Special Education Programs
Placer County Schools
Newcastle, California

Professor Timothy Nugent
Director
Division of Rehabilitation-Education Services
University of Illinois
Champaign, Illinois

Dr. Richard W. Outland
Consultant in Education of Physically Handicapped Children
State Department of Education
Bureau of Physically Exceptional Children
Sacramento, California

Mr. Alphonso Perez
Principal
Widney High School
Los Angeles, California

Mr. Nathan Plung
Principal
Public School 199M
New York, New York

Mr. Ken Price
Teacher
Love Grove Elementary School
Jacksonville, Florida

Mr. Joseph Reynolds
Director of Driver Training
Widney High School
Los Angeles, California

Mr. Richard Scales
Counselor
Kansas State Teachers College
Emporia, Kansas

Mrs. Margaret Scanlon
Principal
Sunshine School
San Francisco, California

Mr. Raphael Simches
Chief, Bureau for Physically Handicapped Children
The University of the State of New York
State Education Department
Albany, New York

Mr. William Spinelli
District Supervisor
Division of Vocational Rehabilitation
Garden City, New York

Mr. Eugene J. Taylor
Adjunct Associate Professor
New York University Medical Center
Institute of Rehabilitation Medicine
New York, New York

Mr. Stanford Taylor
President
Educational Developmental
Laboratories
Huntington, L. I., New York

Mrs. Edna Thompson
Director of Educational and
Psychological Services
California State Schools for
Children with Cerebral Palsy
and Similar Handicaps
Los Angeles, California

Dr. Al Tudyman
Director
Special Education
Oakland City Unified City School
District
Oakland, California

Mr. Richard J. Veenstra
Architect
Jacksonville, Florida

Mr. Charles W. Watson
Chief, Division of Special Schools
and Services
Bureau for Physically Exceptional
Children
Sacramento, California

Dr. John Webb
Director of Student Services
Kansas State Teachers College
Emporia, Kansas

Mrs. Julia M. Wickersham
Supervisor
Exceptional Child Education
Duval County
Jacksonville, Florida

Dr. Ernest P. Willenberg
Director of Special Education
Los Angeles City School District
Los Angeles, California